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Electricity Supply, 1924-1925.

THAT the normal work of the Commission has been seriously disorganised by the intervention of successive Governments, the report of the Weir Committee, the Electricity (Supply) Bill, and other factors, as indicated by the Commissioners themselves in their fifth annual report, was further shown by the issue of that report in 1925 nearly three months later than in 1924, whilst the statistics on the generation of electricity for 1926 (September, in 1924; August, in 1925) have not yet been published. Moreover, the supplementary returns of electricity supply, of which the first volume was issued in May last year for the years 1920-23, have only now appeared, so that we have been largely dependent on published data for the year 1923, at a time when Parliament is legislating for 1940. No blame can be attached to the Commissioners for these delays; we are sure their burdens are already excessive. But it is clear that the work entrusted to them, present and prospective, is severely taxing the physical capacity of their establishment, and the interests of the electricity supply industry are suffering from this fact.

However, at last we have before us the volume* which brings the statistics up to March last year (December 31st, 1924, for companies); it comprises 666 pages, 38 more than its predecessor, but is otherwise cast in the same mould.

We described the earlier volume as a monumental achievement, which reflected upon its compilers the greatest credit, and a similar tribute must be paid to the present issue; the convenient arrangement of its contents, the lucidity and accuracy of the "general review" which precedes the tabular matter, and the "summary tables" which precede the detailed statistics of individual undertakings, leave little to be desired, and the Electricity Commission is to be congratulated upon the excellence of the work.

In our review of the first volume (ELECTRICAL REVIEW, July 17th, 1925, p. 81) we described in some detail the contents of the book, which by this time ought to be familiar to electrical engineers; we have, however, repeatedly observed that men whom one would expect to be conversant with the statistical resources of the industry, and who certainly would have found the Return very useful, have been aware of its existence or of that of the companion volume of administrative returns, published in January, 1925. As we then said, "we have to thank the Commissioners for placing at

* "Return of Engineering and Financial Statistics" of the Electricity Commission. H.M. Stationery Office. Price 15s. net.

the disposal of the electrical industry the most exhaustive information with regard to the statutory electricity supply undertakings of Great Britain that could possibly be obtained." We based upon them several articles accompanied by curves showing the relationship between size, coal consumption, prices charged, and output of electricity supply stations as disclosed by the Return for 1923, from which it appeared that neither in efficiency nor in cheapness of supply were the largest undertakings notably superior to others of quite moderate dimensions; and we hope to examine the newer data on the same bases at a convenient opportunity. A summary of the Return appears elsewhere in this issue.

It is interesting to note that the proportion of roughly 2 to 1 applies to the relative positions of local authority and company undertakings, in respect of not only output and sales of electrical energy, but also capital expenditure, the capacity of generating plant installed, maximum loads, total connections, revenue, working expenses, staffs, and wages; the former class, however, includes 305 undertakings and the latter 235, indicating that the average size of the latter class is considerably the lesser of the two. In respect of sales of energy in bulk the position is reversed, owing, of course, to the operations of power companies. The average price obtained per kWh sold in 1924-25 by local authorities was 1.80d., and by companies 1.71d.; the average working expenses per kWh sold showed a similar ratio of 1.05d. and 0.94d., and again the average cost of generation was 0.47d. per kWh for local authorities and 0.44d. for companies.

Criticism Criticised.

In a leading article last week the *Electrician* took occasion to pass under review various criticisms which have been levelled at the Electricity (Supply) Bill, which appropriately enough is now passing through its most critical stage. Apparently our contemporary is rather concerned lest the admirable progress made under existing conditions, to which numerous recent extensions of power-station plant have borne evidence, should be held to weaken the case for the Bill, by giving rise to the impression that the electricity supply industry could build up a national system if left to itself by the Government.

We are pleased to see that the writer admits that there is substance in the misgivings felt by some of those who have criticised the Government scheme, with regard to the prospective policy of the Central Board and its results, but he threatens them with a "boomerang" on the score of their "rash statements," and proceeds with a counterblast which is sadly marred by an unfortunate slip of the pen.

"One of the main charges of the critics is that the country will be saddled with an expensive bureaucracy, the working capital of which is to be guaranteed by the State; that this body will be under no financial obligation to anyone, but that, on the other hand, existing undertakings will be saddled with additional administrative charges." Such a criticism, he says, is based either on a wilful misunderstanding of the measure or on ingenuousness. But is it? Will not the new establishment be expensive? and is not its constitution typically that of a bureaucracy? ("Bureaucracy—government by bureaux, centralisation, officialism, a set of dominant officials"—the "Pocket Oxford Dictionary," 1925.) Again, will not its working capital of 33½ millions be guaranteed by the State? (Clause 27: "The Treasury may guarantee . . . the payment of the interest and principal of any loan proposed to be raised by the Board . . . provided that the aggregate amount . . . shall not exceed 33½ million pounds.") These items are beyond question; the remaining one is the problem who will be saddled with additional administrative charges, and surely it is clear that if the Treasury does not find the money to pay for the Central Board and its large staff, the electricity supply industry must do so. There is no other source. Eventually, of course, the cost must necessarily be passed on to the consumer. Those charges are "additional," because if there were no Central Board they would not be incurred; the Electricity Commission, with enlarged powers, could do all that was needed, as its past achievements have indicated. No amount of juggling with purchase and resale can affect the plain facts.

Our contemporary says that "arguments are put forward against the erection of trunk transmission lines on the ground that the enormous capital involved will not be able to earn its keep," but suggests that "The Board may, however, be allowed to find this out for themselves. This they will undoubtedly do, and in so doing will realise that the correct policy must be the gradual pushing out of the supply into existing electrified areas and postponing the erection of national trunk lines until conditions allow it." We congratulate the writer on arriving at the conclusions which we propounded many months ago, and from which we have never budged. We only object to one sentence in the foregoing quotations—namely, that the Board may be allowed to find out that trunk transmission lines will not pay by the crude process of disastrous experiment: prevention is better than cure, and if the Board can be prevented from wasting capital in this way our principal object will be attained. Neither the "grid" nor the wholesale standardisation of frequency is a necessary factor in the reorganisation of electricity supply, and we again point out that although such reorganisation has been carried out in various countries, in no country has a scheme such as is embodied in this Bill ever been tried.

Electrical Activity.

Most gratifying are the indications of increased activity in various branches of the electrical trade consequent upon the growth of domestic business. Manufacturers of appliances and retailers who pass goods on to the public have good reason to be satisfied with the demand, and the electrical contractors, registered and unregistered alike, have been having the time of their lives in making extensions to existing installations. Under such conditions grievances become fewer and of less importance because there is little time for worrying about them. Everybody is better when he has a job to do and can get on with it. This is what we should like to be the permanent state of things as the domestic movement gets definitely and more or less permanently into its more progressive stride. As suggested in our "Domestic Electrification Number," there is practically no limit to the work to be done for years to come, though coal rationing and the Campaign are both outstanding contributing causes of present activity and prosperity. The possibilities of accelerating the rate of progress, by means of assisted wiring, have been demonstrated in some areas in a remarkable manner, and the efforts that are being made to meet the needs of the consumer of moderate means who finds it possible to adopt electrical appliances when he or she can purchase them on the part-payment system are exercising an important influence. The predilection of the transatlantic householder for hire-purchase systems has been largely responsible for the immense demand for some electrical products as well as for cheap motor cars over there, and some of the concerns which have profited therefrom in the States have become very much alive in various areas in this country. Their activity is all to the advantage in building up a bigger domestic load, but their direct-dealing house-to-house visitation and demonstration is securing for them a large amount of business which, if things proceeded along our orthodox lines, would have passed through the hands of contractors or retailers, or of electricity supply authorities which happen to be armed with the necessary powers. The consumer is encouraged by the door-to-door demonstrator's offer of the attractive appliance at so much down and so much per month. The said demonstrator acts for concerns which have counted the cost in capital locked up and can stand the racket better than the average contractor. If one can believe all that one hears of the success of these door-to-door

campaigns, then the manufacturer and the consumer are mutually gaining the advantage and the contractor is left with purely installation work to do. However much some interests may deplore the tendency, it were idle to deny that the practice bids fair to become more extensive because it is popular with the public, and that it will add vim to the work of electrical development.

International Industrial Relations.

WE have on several occasions reviewed the indications of the growth of a disposition to view industrial operations from an international standpoint. The American financing of Continental concerns and enterprises, patent arrangements between similar industrial companies in different countries, and other influences marked the tendency. Since our last reference to the subject, many things have happened which can be regarded as steps in the progress of thought. If we regard what has been proceeding from the standpoint of the practical politics of British electrical and allied industries, we may be excused for doing so with more of suspicion and reserve than of cordiality or of optimism regarding the issue. The British electrical industry, whatever may be its foreign interests in particular cases or whatever arrangements individual concerns may find it politic to make, will not be likely as a body to rush in ecstacy into international arrangements when we want work for the vast army of our unemployed and when the question of inter-Imperial trade policy is one of such great moment. Week-end conversations of an unofficial or personal and unrepresentative nature between industrial leaders of different countries nobody can object to, but it will be a long road to travel between mere conversations and practical achievements which can increase world-purchasing power or materially affect the actual competition that takes place between manufacturers in this country and those in Germany, Switzerland, the United States, and so forth. The appeal of bankers and others for the breakdown of barriers to the freedom of international trading was a very interesting document, full of very desirable sentiment, but we are so deeply involved in day-to-day transactions which show how complicated are the difficulties that stand in the way of freedom and friendliness that we can only read, express a hope, and for the present pass on. Continental visitors at unofficial gatherings amid England's rural simplicity have not returned to their Fatherland with reports such as Caleb and Joshua gave regarding the promised land, for over the wires has come the comment from German industrialists that British industry has not reached a sufficiently advanced state of organisation to encourage hopes of international understandings being reached. Precisely what those suggested understandings were we know not, for the proceedings were private, but it is now reported that the Federation of British Industries has invited the German representatives to come over in larger numbers for further conversations; perhaps after the next gathering something definite may be divulged.

Though all that has happened so far may fail to rouse the enthusiasm of some unbelieving spirits, everyone will agree that no avenue should be left unexplored which gives any sign of leading to the promotion of a better system than that of unrestricted cut-throat international competition. It may be something to the good to have discussed the possibilities and found that hopes, in the present constitution of human affairs, can be no more than chimerical.

Few things in connection with this subject are more interesting than the monograph which the British Engineers' Association has prepared for the Economic Conference of the League of Nations. It describes the economic position of the British engineering industry, and would be worthy of extended reference in these pages were there not such heavy demands upon our space just now. The part calling for mention at this moment is its reference to international conferences. We quote: "All the above considerations lead one to the conclusion that although the protection and development of its own engineering industry must be primarily the affair of each of the countries concerned, the interests of all of them might be well served, in the present situation, by international conferences between duly accredited representatives of their respective engineering trade organisation."

Stated briefly, the position is as follows:—The engineering requirements of the world are enormous, but purchasing power is wanting; therefore, the engineering productive capacity of the world is at present in excess of the actual needs. This occasions anxiety to leaders in manufacturing countries where, unless large orders at profitable prices can be obtained, much machinery and plant will be thrown out of action, capital values will be destroyed, and more unemployment will result. We have either to wait for the purchasing power of the world to improve or to find ways for cheaper production, to improve salesmanship, and to make better terms of payment for the purchaser. To wait, says Mr. Bremner, the author of the monograph, is sheer fatalism; the alternative mentioned above means international commercial warfare keener than ever. International leaders, therefore, should watch the position, confer together and endeavour to promote developments calculated to improve the purchasing power of the world. Reduced cost of production must come before there can be increased consumption, for the world cannot buy at high prices. Mr. Ford says pay double wages and you will reduce costs; many a business knows that it would soon have to put up the shutters if it did so in the present state of affairs.

Seeing that the British Engineers' Association was all through the war one of the most stalwart champions of British trade interests as opposed to Continental, it will not be imagined that in favouring the idea of international conferences it is prepared to be a party to anything that will operate detrimentally to the interests of British engineering industry.

The Sydney Contract Dispute.

IN our last issue we briefly announced that the Australian High Court had ruled that it was beyond the powers of the Commonwealth Shipping Board to carry out part of a contract for power plant for the Sydney City Council. This marks the end of one stage of a dispute of some magnitude which interests British manufacturers who competed for the contract. The latter provides for the supply and erection of six turbo-alternators and steam plant at a total cost of about £660,000. The Shipping Board was given the contract in preference to twelve other firms which tendered, and it was agreed that part of the plant should be made by the Metropolitan-Vickers Electrical Co., Ltd., and its Australian associate. Then the Federal Attorney-General stepped in and, as we have reported, secured the suspension of the contract.

Mr. Forbes Mackay, the City Electrical Engineer, recommended, while the action was in progress, that in the event of a decision adverse to the Shipping Board, the whole of the contract should go to the Metropolitan-Vickers Co., Ltd. This course appeared to be regarded favourably by the City Electricity Committee, but there was considerable opposition from members of the Council. Finally, it was decided to appoint a sub-committee to negotiate with the parties interested and other contractors with a view to securing the best terms for the Council. This was done, and it was announced that a tentative agreement had been made with the Metropolitan-Vickers Co. to supply the plant at a price of £644,105. It was stipulated that at least 43 per cent. of the work should be done in Australia.

A meeting of the City Council later ratified this arrangement, although an offer to carry out the work for £557,057 was put in by the Australian General Electric Co. (U.S.A.), which also agreed to adhere to the stipulated delivery dates.

Electricity Supply at Norwich.

The New Generating Station at Thorpe.

THE new Thorpe electricity works of the Norwich Corporation, the opening of which we referred to in our issue of November 5th, is the first section of what will ultimately be, it is anticipated, a 50,000-kW station, the present section being designed for a capacity of about half that amount. Its erection has been brought about by the Duke Street generating station having reached its full-capacity limit. Electricity supply was first introduced in Norwich in 1893 by a company from which the Corporation acquired the undertaking in 1902. From that time continual progress has been made and new plant added from time to time up to the new station in question.

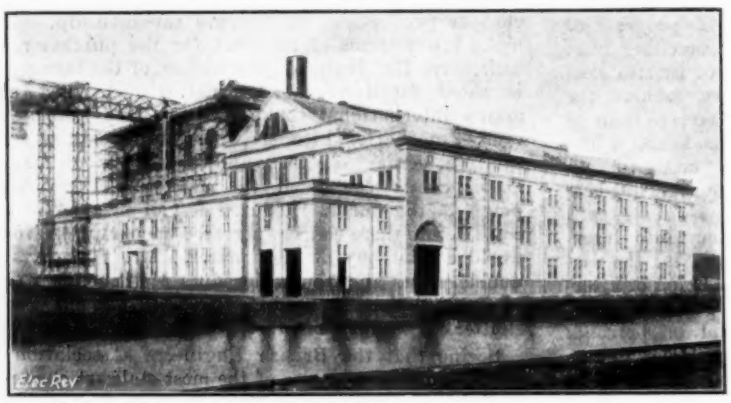


Fig. 1.—A View of the Thorpe Power Station.

The general lay-out of the station is along the usual parallel-bay lines. A switchgear bay, 25 ft. wide, occupies the south side, and a 65-ft. turbine bay lies between this and a 90-ft. triple-bay boiler-house and coal bunkers on the north side. An office block of two floors extends across the whole of the west or permanent end. The buildings are constructed in steelwork, with walls of concrete blocks, which were moulded on the site. These are faced with china-clay quartz from Cornwall, giving the whole a bold and impressive appearance.

The station is served by a siding from the L. & N.E.R. on the west side and the River Wensum on the south side, so that coal can be brought by either rail or river. A telpher track 80 ft. high provides the necessary coal handling from the railway siding to the boiler-house and, when finished, will run over an unloading dock on the river side and form a complete loop to and from the boiler-house. The telpher plant was supplied by Messrs. Babcock & Wilcox, Ltd.

The boiler-house accommodates four 40,000-lb. Stirling boilers, two on each side of a central firing floor. Two of these are equipped with "Underfeed" travelling-grate stokers and two with "Erith-Roe" retort stokers. The boiler working pressure is 250 lb. per sq. in., with 650 deg. F. superheat. Water-trough conveyors, fig. 2, supplied by the Underfeed Stoker Co., Ltd., provide for the removal of the ashes, which they deliver up inclined planes to unloading hoppers outside the building.

Each boiler is served by a Green economiser situated at a level of 33 ft. above the firing floor. Balanced-draught is adopted, the induced-draught fans being installed on the upper floor and the forced-draught fans in the basement—in the case of the Underfeed stokers, on the stokers themselves. The fans were supplied by Messrs. Davidson & Co., Ltd.

All the boilers are fitted with steam-jet soot blowers, and a flue-dust plant by the British Vacuum Cleaner and Engineering Co., Ltd., is provided. An automatic electric Waygood Otis passenger lift serves all the boiler-house floors and the coal bunker staging over the firing poor. One chimney is provided for each pair of boilers.

For the feed water the condensate from the turbines is heated by bled steam to about 150 deg. F., and further to 212 deg. F. in a hotwell fed with exhaust steam from the feed pumps. The make-up water is treated in a double-effect Prache & Bouillon evaporator. It is first pumped from the river to an open storage tank on the economiser floor and passes from the evaporator to a closed tank on the same floor, from which it flows to the hotwell tank placed immediately below. The evaporator delivers three tons of water per hour, which is about 10 per cent. of the amount circulated. The steam consumption is 1,200 lb. per hour. The plant is rendered self cleaning by charging the circulating water with a quartz silicate. Three "Weir" rotary pumps, two steam and one motor driven, on the firing floor feed the boilers.

Two 5,000-kW turbo-alternators, fig. 3, are at present installed. These are of the British Thomson-Houston Co.'s standard design, 3,000 r.p.m., and generate 3-phase current at 6,600 V, 50 cycles. A similar set at present at the Duke Street station is to be shortly transferred to the new works, and provision is made for the installation of a 10,000-kW set at a later date. Each of the turbines installed has a Worthington Simpson condenser with a tube surface of 9,000 sq. ft. served by a 24-in. circulating pump and a two-stage air-ejector and duplicate extraction pumps. The steam from the ejectors is condensed in small surface condensers, and the condensate delivered by the extraction pumps flows through the tubes of these condensers and through a heater, supplied with steam bled from the turbine, before passing through the hotwell.

Fig. 2.—Ash Conveyors and Hoppers.

The circulating water is drawn from the river at the west end of the station and returned at a point 130 yards east. At the intake the water passes through an inclined screen for stopping large matter, and on the

suction side of each circulating pump is a self-cleaning rotary screen for removing the smaller material. The discharge pipes dip under the surface of the water in the discharge conduit, thereby obtaining a syphonic action. The circulating pumps were supplied by Messrs. W. H. Allen, Sons & Co., and the rotary screens by Messrs. Hick, Hargreaves & Co., Ltd.

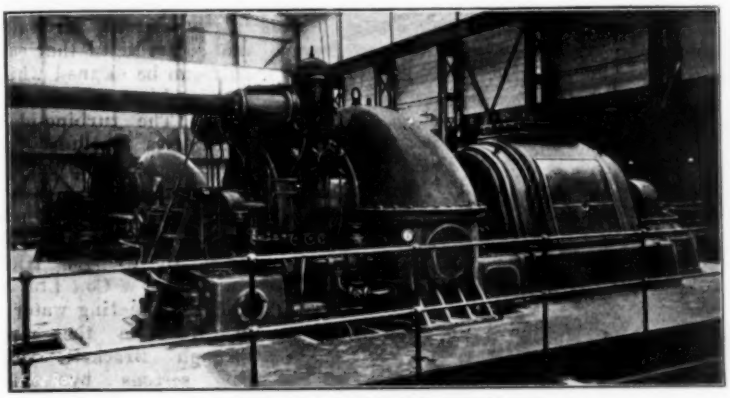


Fig. 3.—The Steam Turbo-Alternator House.

The auxiliary plant, with the exception of the two steam pumps, is driven by d.c. motors, d.c. being adopted because in most cases speed control is desirable. The motors were supplied by Messrs. Laurence, Scott and Co., Ltd. The auxiliaries are to be supplied by two 500-kW rotary converters placed on a floor between the basement and the turbine floor; one of them is at present installed. These will also be used for local distribution. A 250-cell, 458-Ah battery, by the Chloride Electrical Storage Co., Ltd., is provided for emergency use.

The control switchgear, consisting of an open-type d.c. board, h.p. panels, and cubicles for the auxiliary plant, and a remote-control board for electrically operating the main h.p. switchgear, fig. 4, are placed in line facing and on the same level as the turbines. The main B.T.-H. h.p. gear is housed in stonework cubicles with sheet-steel doors. These are arranged in two sections, one on the same floor as the control gear and accommodating the isolating switchgear and instrument transformers, and the other, a continuation of the former, situated on the floor above and containing the machine and feeder switches. The main bus-bars are housed in a set of cubicles on the top floor facing the main-switch cubicles, with a platform gangway between the two sets. Under the platform are run the bus-bar and switchgear connecting cables, which are of the p.i., l.c. type. The operating relays and mechanism for the switches are mounted outside the cubicles at the back. Each of the machine control units is equipped with two relays, one fitted with a time lag, giving the mechanism a "double-throw" operation. Release is effected by separate trip coils which can be hand operated if necessary.

The alternator and feeder switches are designed for phase loadings of 1,200 and 300 A respectively. A 6.5-ohm grid resistance provides for earthing the star point of either of the alternators, this being permissible for only one machine at a time.

Opposed-e.m.f. protective gear is provided for the protection of the alternators and feeders. At present reactors are only utilised between the main bus-bars and the auxiliary switchgear, but arrangements have been made for their installation between the present and future switchgear.

When completed, the new station will transmit the bulk of the energy generated to the Duke Street station for distribution. Three 0.25-sq. in. cables are at present laid for this purpose. Distribution in Norwich is mostly by d.c., but considerable a.c. energy is supplied to the outlying districts. The area is being increased gradually, and the latest development is a supply to Wymondham; plans are also in hand for an extension to Wroxham and North Walsham. It is interesting to recall that the city electrical engineer, Mr. F. M. Long, M.I.E.E., who has been in charge of both the company and municipal undertakings since 1892, introduced the first multi-part tariff, and that the Norwich undertaking was one of the pioneers of the rental wiring schemes.

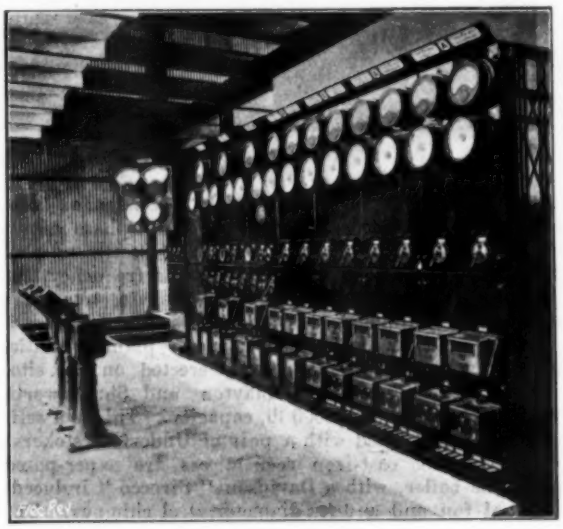


Fig. 4.—Main Switch Control Board.

Mr. J. H. Rider, M.Inst.C.E., of Messrs. Preece, Cardew & Rider, consulting engineers, has been responsible for the design and equipment of the new station.

The Wakefield Electricity Undertaking.

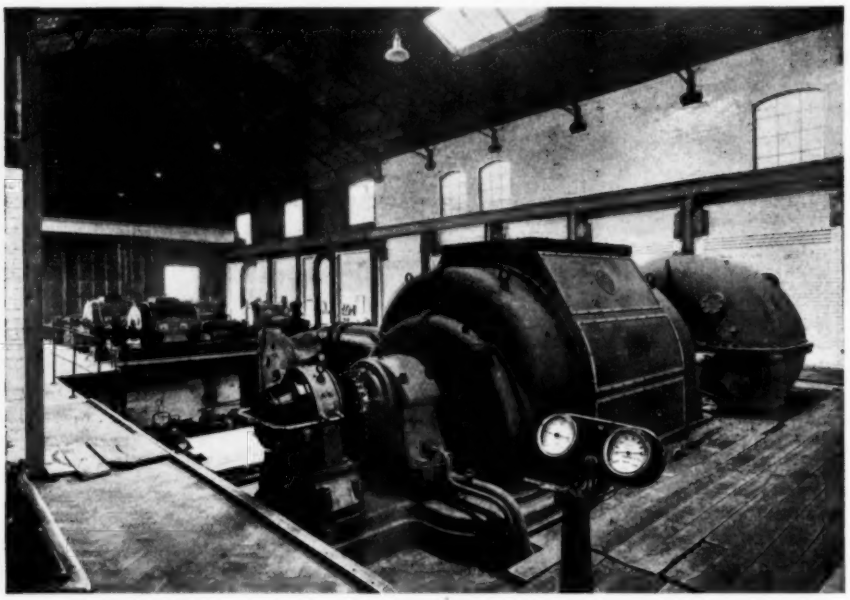
Change-over of the System and Plant Extensions.

THE Wakefield Corporation's electric power station, the inauguration of the recent extension of which we referred to in our last issue, is fortunately placed for the generation of cheap electricity on account of its close proximity to the coal fields and the large available supplies of circulating water for condensing purposes, being situated above the Kirkthorpe Dam on the River Calder, which forms a large pond in the river, having a minimum dry-weather flow of 3¾ million gallons per hour.

At the end of the war the available plant at the power station aggregated 3,750 kW, consisting of turbine and reciprocating equipment supplied with steam from Babcock & Wilcox water-tube boilers, and Lancashire boilers, together with a refuse destructor. The whole of this plant, in addition to being overloaded, was suffering from the inevitable effects of continuous service under the trying conditions of the war. The supply system at that time was 2-phase, 60 cycles, 2,000 V, transformed for use by the consumer to 200 V.

In 1920 sanction was obtained for the first stage of a complete scheme of reconstruction which included an extension to the existing turbine and switch house, the erection of a new pump house at the river, with the

provision of a 27-in. flow and return pipe-line between the river and the power station, and a complete network of 3-core, 6,600-V mains. Two 3,000-kW, 50-cycle, 6,600-V turbo-alternators and the necessary auxiliaries were then installed, and this necessitated the inauguration of a progressive scheme for changing the frequency of the supply throughout the city. Scott-connected transformers were installed in the sub-stations, and the area of supply was dealt with by a district at a time. All new consumers from that time have been connected to the 3-phase mains direct. In addition to the provision of Scott-connected transformers for the change-over of the frequency, the prime movers of two of the old 2-phase sets were scrapped, and 3-phase, 6,600-V motors substituted.



The New Turbo-Alternator at Wakefield.

Early in 1924 the refuse destructor plant was dismantled and a new boiler house erected on the site, in which was installed a Clayton and Shuttleworth water-tube boiler of 50,000 lb. capacity. This is a self-contained unit fitted with a pair of Underfeed stokers; Green tri-tube cast-iron economisers are super-posed above the boiler, with a Davidson "Sirocco" induced-draught fan and a 6-ft. diameter steel chimney. The fuel is shot direct into the bunkers from the original ovehead destructor roadway.

The ashes are dealt with by "Usco" water-sealed ash-handling and conveying plant which delivers into an overhead ash bunker. Provision is made for the installation of a similar unit at a later date.

In 1924 sanction was obtained for the installation of further generating plant, and early in 1925 an order was placed with the English Electric Co., Ltd., for the supply and erection of the new turbo-alternator. This is a 7,500-kW, 50-cycle, 3-phase, 6,600-V set of standard design. The turbine is a single-cylinder machine running at 3,000 r.p.m. The cooling of the alternator is arranged on the "Battersea" patent closed system of the Premier Cooler & Engineering Co., Ltd., and is fitted with a suitable temperature alarm. The condenser, of the same make as the turbine, is constructed in two sections, vertically, and so arranged that each half can be cleaned whilst the machine is in operation. The turbine-plant auxiliaries include two Worthington-Simpson extraction pumps, and a steam-operated "Hick-Breguet" air ejector, fitted by Messrs. Hick, Hargreaves & Co., Ltd.

The circulating water is drawn from the river through Brackett rotating screens by three Mather & Platt motor-driven circulating pumps installed in the new pump-house erected on the river bank, capable of delivering 520,000 gallons per hour under pressure through the condensers by means of a 27-in. cast-iron pipe-line.

The whole of the plant is arranged for a final steam pressure of 200 lb. per sq. in. and a temperature of 550 deg. F. It is temporarily working at 150 lb. and 500 deg. F., but will be changed to the new conditions very shortly, when the remainder of the 60-cycle steam plant will be dispensed with, thereby providing ample room in the existing turbine house for the installation of an additional large turbine set. New switchgear has been supplied by Messrs. Ferguson, Pailin, Ltd., comprising e.h.p. armour-clad, oil-filled, D.V.-type equipment. The whole of the reconstruction work and extensions has been designed by and carried out under the supervision of the city electrical engineer, Mr. H. G. Fraser, and his staff.

Considerable progress has been made in the supply of electricity in the Wakefield area for domestic purposes, and in the hiring-out of electric cookers and wash boilers.

It is interesting to note that the department was in a very favourable position as regards coal stocks at the commencement of the coal dispute, and has been able to give its consumers full benefit of a cheap electricity supply throughout the whole of the summer.

Electricity in the Home.

Common Faults of First Installations.

By H. B.

At the present time there is a greater movement in progress throughout the country than has ever before been made to encourage the use of electricity in the home, and it is certainly surprising to find the number of people who only use electricity for the purpose of lighting, and do not realise the advantages of its many other domestic applications. Where it has been installed for other purposes it is regrettable that the work is done in such a manner as not to give the best results for the householder, and it is with reluctance the author suggests that this is due to the electrical contractor, who does not appear to give the necessary advice whereby the best results may be obtained. One reason for this is probably the fact that when a contractor is asked to give a quotation for putting in an electrical installation he is so keen to get the work that the proposed scheme is cut down to bare necessities, and the installation is carried out in such a way that when additions are required for the further use of electrical apparatus, it is mostly found that a great deal of alteration is necessary in the wiring. Very often on this account a potential consumer gives up the idea of proceeding

any further with the utilisation of electricity for more general purposes in the home. The author does not wish to condemn unnecessarily the electrical contractor; indeed, he has a great deal of sympathy with him, being fully conversant with the troubles which a contractor would have with the average consumer if he were to suggest a great many additions to the original contract.

It will perhaps be more clear if at this point examples of what is meant are given, these examples having actually come within the author's experience. One of the greatest mistakes made in the addition of electrical apparatus is that in so many cases when a power circuit is installed in the average house it is done possibly for the purpose of one radiator being used, and probably four or five plugs are fixed in the different rooms, with the object of moving the radiator from one position to another. These plugs are simply wired by being looped one from the other, the section of the wire only being sufficient for the purpose of one radiator, and the whole circuit being controlled by one pair of fuses. Later it is decided to install another radiator, and upon inquiry it is generally found that the supply authorities are in the position of having to advise the consumers that it will not be wise or safe for them to use more than one radiator at a time. The probable outcome is that the consumer will not go to the additional expense of having his wiring altered, and, therefore, the contractor loses the sale of another radiator, and the supply authorities the sale of additional electricity.

Vacuum cleaners also are generally worked from radiator plugs, and this is a source of danger, for there is no fuse protection for the vacuum cleaner other than the main fuses which control the power installation; that is to say, it is quite possible to have a vacuum cleaner working off a plug which may be protected by a fuse of 30 or 50 A capacity, with the result that if anything goes wrong with the vacuum cleaner it may be seriously damaged.

Another common practice is for a plug installed for the purpose of working an electric iron to be also looped from the radiator plugs; then, again, there is the case of small apparatus worked from a circuit which is only protected by heavy fuses, and as the flexible where it is connected to the iron is the point where trouble arises with an electric iron, very often shorting and fusing at this point, a very severe burn may be received by the person using the iron, and thus cause the householder to become rather afraid of electrical apparatus.

Insulated switches do not appear to be sufficiently used, and more so in these days when so many of the supply undertakings have changed their systems of supply from direct to alternating current. Many of the so-called insulated switches have insulated covers, but metal dollies, which, of course, does not meet the requirements for an insulated switch. It would undoubtedly be better for all purposes if nothing but insulated switches or metal-covered switches properly earthed were installed, for although an installation may be passed by the supply authorities, and there is apparently no danger of receiving a shock from any of the switch positions, many cases have come under the notice of the author where metal pipes have afterwards been placed near the switch, and thus rendered a shock-proof switch necessary. Whilst there are many regulations which compel anyone who is installing electrical wiring into premises to keep it clear of gas pipes, there does not seem to be any requirement for people installing gas piping after an electrical installation has been put in to keep their pipes away from y electrical conductors or tubing.

In conclusion, the author would like to emphasise the necessity for anyone who is putting in electrical power installation to have this wired to a distribution board, so that each piece of apparatus can be protected by its own fuse, which can be of such capacity as to afford safety in working.

Automatic Telephony at Edinburgh.

Four New Exchanges Equipped by Messrs. Siemens Brothers & Co., Ltd.

The Edinburgh telephone system was changed over from manual to automatic operation on October 3rd, involving the transfer of some 12,000 working subscribers' lines and 2,100 local and trunk junction lines. It is claimed to be the biggest cut-over yet made by the British Post Office, and four new automatic exchanges were brought into service simultaneously and most successfully.

The Edinburgh network comprises 10 exchanges, the four new ones being those referred to in Table I.

Table I.

Exchange.	Type.	Number of lines (multiple). Initial Equipment.	Ultimate Capacity.
Central	Main	9,300	14,600
Morningside	Satellites with discriminator repeaters	2,500	4,400
Newington		2,100	3,600
Murrayfield		1,700	2,900
Total		15,600	25,500

The other exchanges within the local fee area remain manual at present, and their subscribers ask their respective operators for the 5-digit automatic numbers, the operators completing the connections by dialling direct into the Central exchange, either its numbers or those of its satellites; only one group of junctions from each manual exchange to Central has been provided for all connections to automatic subscribers. When the latter require exchanges outside the local fee area (toll or trunk calls), they dial "O" and are attended to by operators at the manual board located in Central; a ticket is made out by the "O" operators for each trunk call, which cannot be completed direct without delay, and all tickets are passed to trunk operators for attention. Special services are all centralised at the Central exchange and are obtained by dialling 2-digit codes. Short-distance trunk lines are taken to first selectors, and distant-trunk operators dial automatic subscribers direct; other trunk lines

Fig. 1.—Central Auto-Room showing Test Desk.

are taken to trunk positions on the manual board, all trunk positions being provided with dials to complete calls direct to automatic subscribers.

The automatic system is of Messrs. Siemens Bros. and Co.'s automatic equipment No. 16 type, and it

embodies several interesting features, *viz.*:—First pre-selectors, one for each subscriber's line; second pre-selectors for concentrating the originating traffic on to first selectors, so materially increasing the traffic load which may be carried by the selectors and providing an efficient scheme by the use of simple 10-point pre-selectors. The transmission bridge is located in the first selector, from which transmitter current is supplied to calling and called lines on local connections; the bridge for incoming calls supplying current

Fig. 2.—Morningside Auto-Room.

to the called line is located in the incoming selector to which the junction is connected. Links between selectors are graded on a distributing frame, the design of which was originally introduced by Messrs. Siemens. Intermediate distributing facilities are provided by a "sectional" type of intermediate frame placed between the first pre-selector racks and the final selector racks, which are arranged in one line; the design of this frame provides for jumpering between lines in the same row of racks, and easy access to the jumpering field of the adjacent rows of racks, but naturally its sectionalised form does not provide the full facilities obtained by a separate manual type of frame. All racks are of the open type, on which the apparatus is mounted on one side and the wiring carried out on the other, so that all parts of both apparatus and wiring are freely accessible.

Central Exchange.—The equipment on the ground floor only (8,300 numbers) has been installed at present, but so soon as the old manual switchboard is removed another 1,000 numbers will be arranged on the second floor to complete the initial equipment.

The main distributing frame has 89 verticals, with 220 circuits per vertical on the line side and 200 on the exchange side; two travelling ladders serve each side of the frame. The test desk (fig. 1) consists of eight positions, and provision has been made for its extension to 12 positions. It is of standard type, having a filing section between each pair of testing sections, designed for centralised testing with test junctions to all automatic exchanges.

The power plant comprises two motor-generator sets, each of 1,000 amps. at 69 volts; two batteries, each consisting of 30 cells, having plates for 3,666 amp.-hours, and counter-e.m.f. cells have been provided for energising the 30-volt power leads to 330 (ultimately 480) p.b.x. switchboards. One of the ringing machines is driven off the power mains and the other off the exchange battery; the power board is arranged for single-pole switching, and the starters for the motor-generators are mounted on separate framework near the machines.

Temporary manual equipment has been arranged at the Central exchange pending the installation of the permanent suites in the old manual switchroom; the equipment at present consists of (*a*) a manual switchboard of 31 No. 10 c.b.-type sections arranged as follows:—One cordless "B" position with a sender of 5-digit key strips; seven trunk positions, each equipped with seven cord circuits; two special control positions, each equipped with seven cord circuits; five jack-ended junction positions, each equipped with 17 cord circuits; 15 "O" positions, each equipped with 13 cord circuits; and one service p.b.x. position equipped with 13 cord circuits. (*b*) 365 answering jacks and lamps are disposed over the suite and cabled to a manual intermediate distributing frame to which all calling and auxiliary equipment is cabled separately, so that by cross-connections the circuits on each position can be arranged to suit traffic requirements. (*c*) A monitor's desk of 12 positions; and (*d*) a supervisor's desk of one position.

Satellite Exchanges. — The three satellites are of the same type (figs. 2 and 3). Discriminator repeaters, in conjunction with finder switches, direct each call (prior to the commencement of dialling) to a junction to the Central exchange and to a local discriminating selector; as soon as the digits dialled determine the call to be a local one, the junction is freed for another call; if the call is not local, the discriminating selector is freed and the call is completed over the Central junction. All calls between the satellites are routed through Central. Apart from the discriminating equipment, all switches are of the same type as that at the Central exchange.

Service Observation.—Equipment recently developed for centralising observation services at the Central exchange will be installed shortly. A 2-position desk will be used and will initially provide for observing the service on any selected 50 subscribers' lines at the Central and 25 subscribers' lines at each of the satellite

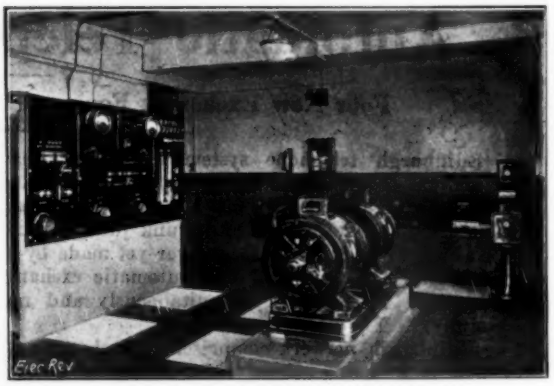


Fig. 3.—Morningside Power Room.

exchanges. With this equipment a single junction between the distant exchange and the observation centre suffices to enable the service of 25 subscribers to be observed.

We are indebted to the Engineer-in-Chief of the Post Office for permission to publish details and photographs of the equipment.

Semi-Jubilee at Tynemouth.—At the invitation of Mr. C. Turnbull (borough electrical engineer) and Mrs. Turnbull, the members of the Tynemouth Corporation Electricity Department were entertained to dinner on October 29th to celebrate the completion of the 25th year of the electricity undertaking. The Mayor, referring to the progress made since its inception, stated that the receipts had increased from £3,400 in the first year to £58,700 in the year just completed. Despite the coal dispute, a record of over 2,000 consumers had been connected during the current year. During the evening, Mr. and Mrs. Turnbull were presented with a crystal table standard by the members of the Department.

Overhead Transmission Lines.

A Method of Determining the Economical Span Length for a Wooden Pole System.

By E. A. LOGAN, M.Sc.

WHEN wooden pole overhead transmission lines were first erected, lack of experience and the demands of reliability resulted in lines with what would now be considered short spans. As experience was obtained, it became evident that span lengths could be increased without sacrifice of reliability. The limit to the desirable span length was found to be decided, however, by the strength of the pole foundations, and not by considerations of economy, *i.e.*, the maximum span length

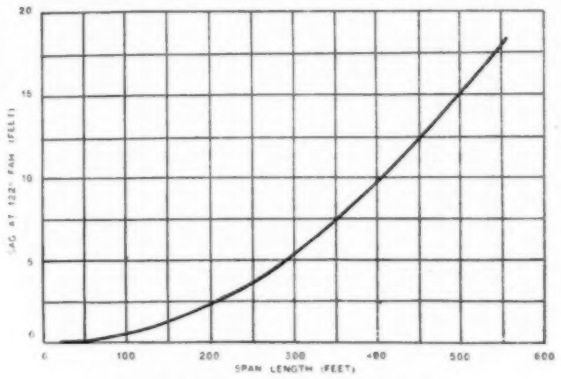


Fig. 1.—Permissible Sag of Conductors.

which could be employed was automatically the most economical. Improvements in the design of wooden supports have, however, resulted in the production of structures capable of carrying spans longer than the economic span length, and still providing the factor of safety of 2.5 against overturning specified in the Regulations for Overhead Lines (El.C.39) prescribed by the Electricity Commissioners. It now becomes necessary, when employing these improved types of support, if they are to be utilised to the best advantage, to determine the economic span length for the type of line considered.

There may, of course, be conditions under which the span lengths for a wooden-pole transmission line may be settled by considerations other than those of minimum cost, such as the terms under which the wayleaves are granted or the geographical features of the route, but in general it is desirable to make an estimate of the economic span length for the required type of line. This figure will then serve as an optimum figure, and the line supports can be arranged at distances as closely approximating to it as circumstances permit.

The method described below has been employed for deciding the span lengths of a number of lines which are now in commission, and since its introduction, normal span lengths up to 450 ft. are now being erected where previously span lengths of the order of 180-240 ft. were employed. Of the several factors affecting the cost of a transmission line, some are variable, and to some extent, independently variable. In practice, over certain ranges of values, some of the variable factors increase by definite steps, for example, the heights of poles which are supplied by timber merchants do not increase continuously, in the mathematical sense, but by finite steps; also the guaranteed minimum diameters of poles as purchased fall into a number of distinct sizes. Advantage may be taken of this fact to convert what would be a somewhat intricate mathematical investigation having probably only a slight practical bearing into a comparatively simple calculation, giving results which may be directly applied. Assuming the size of conductor to have been decided upon, a chart showing the permissible sag of the conductors at the specified maximum temperature may be prepared on the lines of fig. 1. The height of support necessary may then be determined, since the length of wooden pole required in level country is the sum of the length below ground, the ground clearance to the lowest line conductor, the amount of sag of the conductor, and the length of pole above the point of support of the lowest line conductor (see fig. 2).

The length below ground is usually fixed for any given length of pole; for example, a 30-ft. pole may be specified to have 5 ft. of its length below ground; a 35-ft. one, 5 ft. 6 in.; a 40-ft. one, 6 ft., &c.

The minimum clearance of the line conductors at the maximum temperature usually specified, 122 deg. F., is 20 ft. for lines up to 66,000 V. To allow for unevenness of the ground, 21 ft. may be allowed. The length of wood pole above the point of attachment of the lowest line conductor would not vary over a considerable range of span length, and for a given design may be, say, 3 ft. Thus for any given length of pole there will be a certain length of that pole available to provide for the sag of the line conductors. Having ascertained this figure, the corresponding maximum span length at which poles of this size may be placed, may be read off the sag chart. To take an example: the 40-ft. pole mentioned above would have 40 ft. – (6 ft. + 21 ft. + 3 ft.) = 10 ft. available for sag of line conductors. From fig. 1 we see that 40-ft. poles with that particular size of conductor would be placed 405 ft. apart. It is

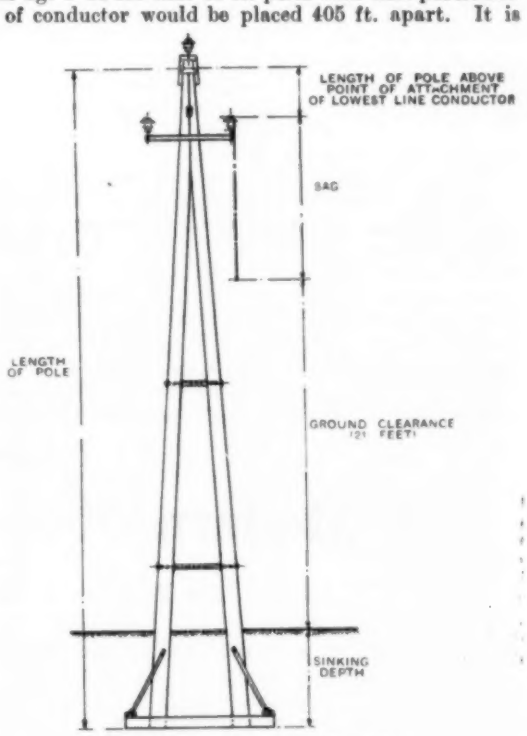

LENGTH OF POLE ABOVE POINT OF ATTACHMENT OF LOWEST LINE CONDUCTOR
SAG
LENGTH OF POLE
GROUND CLEARANCE (21 FEET)
SINKING DEPTH

Fig. 2.—Wooden Transmission-line Pole.

evident that the cost per mile of a transmission line with line conductors of a given size will be at a minimum when the cost per mile of erected line supports, insulators and capitalised wayleaves is at a minimum. A table may be prepared, and a curve plotted from it, of the cost per mile of line supports, insulators and capitalised wayleaves for various poles and the corresponding span lengths.

To refer again to the 40-ft. pole, assuming this to have been ascertained to cost £18 9s. 6d. complete with insulators, or £25 19s. 6d. with capitalised wayleaves costing £7 10s. per pole, placed at the maximum span, 405 ft., as they would be ideally, the cost per mile of

the line supports, insulators and wayleaves would be £340. The following is a typical schedule, and the curve (fig. 3) has been plotted from it. The prices of supports may be estimated prices, or may be actual contractor's tender prices if these are available at the time the line is projected.

Length of support.	Price of complete support.	Permissible sag.	Span length (.1 sq. in. conductors).	Cost per mile for line supports, wayleaves and insulators.
ft.	£ s. d	ft. in.	ft.	£
34	22 8 0	4 6	275	437
36	23 12 0	6 6	330	378
38	24 18 6	8 0	365	360
40	25 19 6	10 0	405	340
42	27 6 0	10 6	415	348
45	27 15 0	13 6	475	308
50	31 4 0	17 0	527	315

It will be noticed that the minimum of the curve at 475 ft. gives the most economical span length for this particular line.

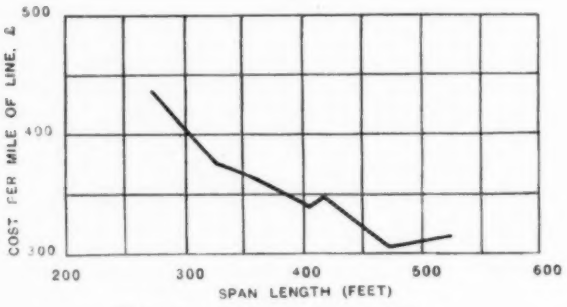


Fig. 3.—Cost per Mile of 0·1 sq. in. Line.

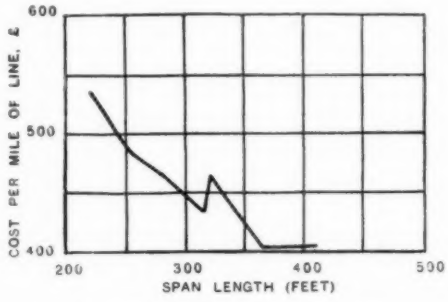


Fig. 4.—Cost per Mile of 0·05 sq. in. Line.

There is this point to be borne in mind, however, that the poles may not be strong enough to provide the factor of safety specified in the Overhead Line Regulations when subject to the transverse load consequent upon being placed at this span length, and therefore the next procedure is to make a calculation to show whether they are strong enough.

Taking the figure of the strength of a 40-ft. simple "A" pole, as decided by the load which it will sustain before failure of the foundations occurs, as being 15 cwt. for a load applied two feet from the top, and allowing for wind pressure on the line and earth conductors and on the pole as laid down by the Overhead Line Regulations previously referred to, the maximum safe span length will be found to be about 140 ft. This figure of span length may appear to be absurdly short, and even in practice this type of pole would probably be placed at greater span lengths than this. The point is, of course, that the requirements of the Electricity Commissioners with regard to foundations would not be complied with. It is evident, however, that it is not possible to erect this type of pole at the most economic span length. Even if the risk were taken of using a span length of 300 ft., fig. 3 shows that the cost of line supports, insulators and wayleaves would be more than one-third as much again as it would be if the most economical span length were employed.

The "AnchorA" pole having the improved type of foundation, described in the ELECTRICAL REVIEW of November 5th, 1926, will resist under similar conditions a maximum load of 3½ tons and the maximum span length at which poles of this type can be erected is 800 ft., i.e., greater than the economical span length of 475 ft. Examination of fig. 3 reveals that the curve is comparatively flat over a considerable range of span length. Taking advantage of this, the spans on the actual line could be made to fall within the limits of, say, 450 ft. and 550 ft. without any great sacrifice of economy. One interesting fact which can be demonstrated by arriving at the economical span lengths of lines by this method is that it is sometimes cheaper to erect the heavier of two given conductors. As an example of this, fig. 4 shows the cost per mile of line supports, insulators and capitalised wayleaves of a three-phase, 0.05 sq. in. copper line on similar poles to the 0.1 sq. in. line previously considered. Comparing the two curves, figs. 3 and 4, the minimum cost per mile for the 0.1 sq. in. line in fig. 3 occurs at 475 ft., and is £308; the minimum cost per mile for the 0.05 sq. in. line in fig. 4 occurs at 365 ft., and is £403. The difference in cost, £95, is almost sufficient to pay for the increased amount of copper, without making any allowance for the lower line operating losses in the larger section of conductor.

A Modern Shop-Lighting Installation.

The New Premises of Messrs. Austin Reed, Ltd., in London.

WHAT is claimed to constitute the most complete men's outfitting shop in London was recently opened by Messrs. Austin Reed, Ltd. Situated in the Regent Street Quadrant, the new building has to bear comparison with others in what is probably one of the best-lighted shopping districts in the metropolis. Although the full effects of the lighting scheme cannot yet be appreciated, as the restrictions due to the coal miners' strike prevent the use of the complete installation, enough can be seen to justify the claim that the lighting is at least equal to that of any of its competitors.

The electricity supply is taken from the mains of the St. James and Pall Mall Electric Light Co., Ltd., Designed originally for the use of direct current throughout, it was realised that the lighting load would be more than the existing d.c. street mains could carry, for the recent rebuilding of Regent Street, involving large increases in the sizes of the buildings and also in the illumination required, has placed a very heavy load on these cables; accordingly, for Messrs. Austin Reed's building, in common with a number of others in the neighbourhood, it has been found necessary to utilise the high-voltage a.c. mains of the Company for lighting purposes. Power equipment and a duplicate emergency lighting system for the staircases, &c., are fed from the d.c. mains.

From the incoming supply to a transformer chamber in the sub-basement of the building, duplicate services have been provided with transformers on each to convert the 6,600-volt, 3-phase supply to a 2-phase, 3-wire, 220-volt system. The secondaries of the two services are taken to a triple-pole change-over switch, so that in the event of a failure of one, the lighting can be changed over to the other with a minimum of delay. From the centre terminals of the change-over switch the two sides of the 3-wire system are taken to two main 500-amp. circuit breakers controlling the

lighting, from which connections are made to the main fuseboards. The whole of this main distribution system, together with similar control gear for the d.c. lighting, d.c. power, and a.c. heating and small power is all assembled in a main switch-room adjacent to the transformer room. The distributing cables in the building have been run on standard lines with two separate lighting mains and two separate heating mains (for the north and south ends respectively) to every floor, and also for the window lighting, decorative lighting, &c.; the cables are all run in heavy-gauge screwed tube up special pipe ducts.

The whole of the machinery, including the central-heating plant with its oil-fired boilers, the passenger and service lift gears, the artesian well and pump (electrically driven) the ventilating plant, the vacuum-cleaning plant, the Lamson tube compressors, &c., has been concentrated in one area, shut off from the rest of the building, to facilitate its control. The remainder of the sub-basement is given over to storage, and is served by a heavy goods lift and a special lift to the Collar Department on the ground floor.

Each department is fully equipped with the latest apparatus for the convenience of customers. In the Boot Department X-ray examination ensures a proper fit, and in the Hat Department there are electrically-operated polishing pads, heating irons, and shaping

Fig. 1.—An Example of Modern Shop Lighting.

pads, similar equipment having been provided, where necessary, in other departments. The Toilet Saloon has its electrically-heated dryers, towel cabinets, &c., and in the various changing and dressing rooms there are electric radiators, special reflectors for the mirrors, and, in a proportion of them, "daylight" lamps for colour matching; "daylight" lamp standards have also been provided on the counters in those departments where colour matching is of importance.

The lighting schemes on the various floors are very effective. The fittings on the five lower floors, made by the General Electric Co. to the special designs of the architects, Messrs. Westwood & Emberton, embody "Verilux" glassware. The fittings on the other selling floors have been supplied by Messrs. Louis Dernier and Hamlyn to suit the Tudor design of the upper floors, which are panelled in oak throughout; the same firm has also supplied the entrance fittings and those in the changing rooms and elsewhere. A special fitting in four tiers, figs. 2 and 3, in the well from the second to the ground floors was supplied by Messrs. Singers, of Frome, to the architects' design, and also the staircase brackets (modelled in plaster), the lift grille, and other items.

The window lighting on both ground and mezzanine floors has been carried out with British Thomson-Houston reflectors of the "Jill" type, spaced 12 in. apart, with lighting signs, spot-light fittings, and other special effects; power plugs are also provided in each window for possible moving exhibits. B.T.-H. reflectors of the "Scoopette," "Hood Junior," and "Hood" types have also been used for the counters, numerous show-cases, and other special lighting. A unique feature will be the decorative lighting scheme, but unfortunately the present lighting restrictions prevent its use at present. Tests that have been made, however, have shown that this section of the installation will not be the least striking of the lighting effects. The window and decorative lighting is all controlled by

Fig. 2.—Well Lighting and Other Fittings.

Venner time switches, so that part, or all, of the lighting can be left on for fixed periods after the shop has been closed to the public.

Various other electrical systems include "Magneta" electric clocks on all floors; night watchman's clocks; bells and telephones, and other items that make the electrical equipment as complete as it could well be.

The contractors for the principal sections of the engineering equipment were as follows:—Lifts, Messrs. Smith, Major & Stevens; heating and ventilating,

Fig. 3.—Top Portion of Well Pendant.

Messrs. Rosser & Russell; vacuum-cleaning plant, the Plenum Heating Co.; tubes, the Lamson Pneumatic Tube Co.; artesian well, Messrs. C. Isler & Co.; and for the sprinkler system, the Automatic Sprinkler Co. The whole of the lighting installation and all other sections of the electrical equipment have been carried out by Messrs. Tyler & Freeman, to whom we are indebted for the details and photographs reproduced above, who were also responsible for the design of the electrical scheme in all its details.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.—The British Electrical Development Association informs us that during the week ended November 6th further circles were formed in the following districts:—Hendon, Aylesbury, Cardiff, and Evesham. Richmond and Surbiton are covered by the Kingston-on-Thames and Twickenham circles reported last week. During the week demonstration electric homes were opened at Birmingham (2), York, and Edinburgh. Reference to these is made below. The Manchester Corporation has agreed to provide a staff and free energy for a demonstration house to be opened at Denton shortly. Model homes are to be opened soon at Low Fell and Bishop Auckland by the Newcastle-upon-Tyne Electric Supply Co., Ltd. It is intended to open a house at Aberdeen before Christmas, and Huddersfield is arranging for the opening of one in the near future. With regard to funds, it is stated that the Scottish Circles have raised nearly £1,400, including a sum of £750 received from the Electrical Contractors' Association of Scotland. Huddersfield proposes to raise £200. The Leicester contractors have subscribed £230, and it is reported that the Corporation will subscribe £200. Many examples of additional local advertising have been submitted to the Association during the week. The London District Officer is touring Kent, Surrey, and Sussex with a view to getting local circles set up. No. 4 of "Home Lighting News" is published this week.

The York Electricity Committee has had a house fitted throughout by local contractors, and it has been thrown open for inspection. Demonstrators have displayed the latest lighting, heating, and labour-saving devices.

Two all-electric houses were opened to the public at Birmingham on November 1st for a period of three weeks. The houses were lent for the purpose, and have been equipped in a very thorough manner. Two local firms have lent the furniture, and the electrical appliances have been supplied jointly by the Corporation Electric Supply Department and the local Committee.

We have already depicted one of the Birmingham Electric

The Birmingham Electric Supply Department's Premises.

Supply Department's windows. Another view of the premises appears in the accompanying figure. This shows that the Department is making good use of the prize-home posters.

Mr. E. Seddon, Corporation electrical engineer, Edinburgh, presided at a meeting held under the auspices of the Local Committee on November 1st. The chairman having explained the aims of the campaign, Mr. H. E. Hughes, district engineer of the Scottish Electric Lighting Service Bureau, gave an outline of the plans for the campaign, and said the people of this country were ready for the electrical age. Mr. Walter Finlay, representing the Electrical Contractors' Association of Scotland, expressed the Association's approval of the scheme.

Under the auspices of the Edinburgh District Committee an all-electric demonstration house was opened in Portobello Road on Saturday last. It is to remain open to the public until November 27th. Mr. E. Seddon is chairman of the Committee and Mr. A. W. Stevens secretary and treasurer. The committee is representative of supply authorities, manufacturers, wholesalers, and contractors.

At last week's meeting of the Halifax Town Council an amendment to refer back a proposal of the Tramways and Electricity Committee "to supply free electric current for the demonstration houses, in connection with the 'Better Home Lighting' campaign, and that the necessary services be laid to such houses free of cost" was defeated, the Committee's proposal being approved.

German Company Changes.—A correspondent says that discussions are proceeding within the Siemens group concerning the transformation of the Siemens-Schuckert Works, Ltd., into a share company. As a result of the legislative changes in the matter of taxation in recent years it is stated that the advantages of a limited company from the taxation point of view have nearly disappeared, and there is therefore no longer any reason for not proceeding with the transformation of the company in question into a share company. As a share company it is more easily possible to approach the money market.

The N.U.M. and Tariffs.—Mr. George Terrell (president) was the chairman at a meeting held under the auspices of the National Union of Manufacturers in Manchester last week. It was decided to form a Manchester branch of the Union, and, later, the chairman urged that a tariff should be imposed upon all imported manufactured goods other than food, when they were produced under conditions which made competition by British manufacturers impossible. Sir Charles Wilson, M.P., in the course of a speech, said that the Union was destined to become a power in the land. The Government's Electricity Bill was one matter in which the Union could protect the public from an extension of bureaucracy. Mr. E. A. Radford, M.P., urged the need for protection of our industries, and spoke of the good effects of the preference accorded by the Dominions to British goods. The fiscal policy of the Union (for the imposition of a "considered" tariff upon foreign manufactured goods) was reaffirmed.

Imperial Conference Delegates at Trafford Park.—A party of delegates to the Imperial Conference paid a visit to the Trafford Park works of the Metropolitan-Vickers Electrical Co., Ltd., on Saturday last. They were able to inspect plant in progress for many important Home, Colonial, and foreign power stations, railways, mines, factories, &c. Of particular interest to Dominion representatives were the motor-coach equipments for the Sydney Suburban Railway, electric locomotives for the G.I.P. Railway, India, power plant for the Sydney City Council, h.p. switchgear and transformers for the Witbank station of the Victoria Falls Power Co., and outdoor switchgear for the Canadian General Finance Co.

Electricity in the Market Place.—We illustrate herewith one of the two Preston Corporation market places which have

An Electrically-Lighted Market Place.

been provided with electric lighting. A very even distribution is obtained by the use of "Siemens" 500- and 750-W gasfilled lamps in dispersive steel reflectors.

A Prize Shop Window.—During the recent Civic Week at Manchester, the *Daily Despatch* offered a cup for the best-dressed shop window. This was secured by Messrs. Forsyth Bros., Deansgate, who "staged" a music room of 200 years ago with one of modern times. The lighting was carried out with "Gecoray" equipment by Messrs. J. Lomax Kendall and Co.

Large Pumping Station at Newport.—On October 26th, a conference was held at the offices of the Newport Harbour Commissioners to hear and consider the objections of interested parties to the Corporation's scheme for the provision of a pumping station on the banks of the Usk. Rear-Admiral C. E. Monro, of the Board of Trade (Mercantile Marine Department) presided. The Newport Harbour Commissioners had already given their approval to the scheme and supported the Corporation's application. At the conclusion of the conference the president intimated that the Board of Trade would now proceed to final consideration of giving assent to the scheme. The scheme provides for a station having an ultimate capacity of 4,000,000 g.p.h. The estimated cost of the scheme is approximately £73,000, including delivery and discharge pipe lines and outlet works situated further down river. Subject to the sanction of the Electricity Commissioners, the Corporation has decided to accept the tender of Sir William Arrol & Co., Ltd., for the civil works and that of Messrs. Worthington-Simpson, Ltd., for the pumping plant, including screens.

Rubber Meetings.—The programme of the Institution of Rubber Industry for the 1926-27 session includes a number of papers likely to interest those concerned with the use of rubber in various branches of the electrical industry. At the London and District Section a paper on "Selenium" is to be read by Mr. C. R. Boggs on November 23rd; on January 10th Mr. G. Martin will introduce "Ageing of Raw and Vulcanised Rubber"; and on March 7th a paper on "Some Electrical Properties of Rubber" will be contributed by Mr. P. Dunsheath. These meetings, as well as those of the Sales Section, will be held at the Engineers' Club. The subjects coming before the Sales Section are: Why Advertising is like Rubber; Wholesale Selling; Co-operative Advertising; Retail Selling; Export Selling; and What Constitutes a Good Traveller? Other subjects are to be brought before the Manchester, Liverpool, Birmingham, and Edinburgh branches.

Local Exhibition.—TUNBRIDGE WELLS.—One of the principal features of the Tunbridge Wells electrical exhibition, which we recorded recently, was the baking demonstration depicted in the accompanying illustration. This was arranged by Messrs. PAINE, SMITH, Ltd., bakers, in conjunction with Messrs. G. & A. J. Cross, Ltd., electrical engineers, Tunbridge

Electric Baking at Tunbridge Wells.

Wells. The baking equipment was supplied by the General Electric Co., Ltd., and the mixers by the Artofex Engineering Co., Ltd. The equipment kept two bakers and an assistant busy during the run of the exhibition, and proved itself capable of meeting all the demands made upon it. Messrs. Cross also had a comprehensive display of domestic labour-saving devices of all kinds.

The Prospect for Engineers in China.—This subject was discussed by Mr. R. L. Sarjeant in a lecturette delivered before the Junior Institution of Engineers on October 15th. Mr. Sarjeant gave an idea of the difficulties, both racial and technical, which kept the conditions of life in China in such an elementary state. There was entire lack of co-operation amongst the Chinese, he said, and there were no really practical native engineers. There were some highly-trained technical men, but they were of the class that would be horrified at the mere idea of soiling their hands with manual labour. It might be thought that in those circumstances there would exist golden opportunities for foreign engineers to take public works in hand, and no doubt there were many Chinese who would be only too glad to see that take place. That, unfortunately, was where racial prejudice came in, and the anti-foreign feeling of the uneducated masses rendered outside assistance extremely difficult of application. Even when influential Chinese did promote public schemes for lighting, &c., and install the necessary plant, maintenance and depreciation were items grossly neglected, so that the undertaking did not endure for long. However, the present disturbances would pass over, and in a very few years great progress should be made. Mr. Sarjeant gave in his lecturette, and also in answers to specific questions from members, particulars of the training, experience, and duties required of young engineers for different parts of China, and he also described the kind of life that was led and what it cost.

Growth of the American Radio Industry.—The tremendous growth of the United States radio industry is manifested by statistics published recently by the Department of Commerce. In 1925 the value of all radio apparatus manufactured was $170,390,572, an increase of 215.5 per cent. on the 1923 production of $54,000,470. The number of valve receiving sets manufactured increased from 190,374 in 1923 to 2,180,622 last year, and the number of valves from 4,687,400 to 23,934,658, the rates of increase being 1,045.4 and 410.6 per cent. respectively. Crystal sets fell from 223,303, valued at $669,906 dollars in 1923, to 112,656, valued at $344,079 in 1925. —*Reuter's Trade Service* (Washington).

Unemployment.—The Employment Exchange returns for October 25th showed that a total of 1,516,200 persons remained wholly unemployed. This was 4,275 less than on October 18th, but 283,804 more than on October 26th, 1925.

G.E.C. Activities in China.—Despite the political and military position in China, the General Electric Company (of China), Ltd., reports fair business in the Far East. It predicts heavy fighting very shortly between the Northern and Southern Chinese, but hopes this will not reach Shanghai, as it would have a serious effect on British trade. It is pointed out that business naturally suffers severely from the difficulty of moving cargo up-country whilst so many soldiers and bandits are over-running the whole place. Orders taken recently include 41 "Witton" d.c. motors, 2½ h.p. up to 25 h.p., and a 110-kW motor-generator set with 2-panel switchboard for a large tobacco factory; a 100-h.p. motor for the Whangpoo Conservancy Board; 75 "G.E.C." fittings for the Shanghai Race Club; a 200-kW, 3-phase alternator with l.p. switchboard for a Chinese cotton mill; and 30,000 "Kinarko" carbons (repeat order), and two motor-generator sets for a kinema company, as well as 24 searchlights for the Chinese military authorities. The power and lighting installation of the new Shanghai Custom House, is being carried out by the company, "G.E.C." conduit being used throughout. "G.E.C." fittings are also being supplied for the equipment of a new Hong-Kong hotel, and 500 Chamberlain & Hookham meters and five transformers are being supplied to a prominent electrical company. Upwards of 50 "Express" lifts have also been installed in China during the last few weeks.

Important Mexican Developments.—It is understood that one of the largest flood prevention, irrigation, and hydro-electric enterprises ever undertaken in Mexico is provided for in a contract signed by the Mexican Government and the Mexican Light and Power Company. The project calls for an expenditure of about 18,000,000 pesos, equal to approximately £1,800,000. The contract calls for the construction of a great concrete dam across the River Lerma, near Contepec, in the State of Michoacan. The Mexican Light and Power Company expects to spend about £1,500,000 in the construction of the dam and hydro-electric plant, while the Mexican Government will spend several million pesos on the irrigation part of the project.—*Financial Times.*

German Enterprise in Russia.—The Berlin correspondent of *The Times* states that various German undertakings in Soviet Russia are understood to be making little progress owing to the difficulty of dealing with the Soviet authorities. The difficulties with which the Siemens Company has to contend in carrying out its contract for the construction of an electric underground railway in Moscow are reported to be so great that the American interests which are financing the undertaking have expressed the desire to obtain release from the contract even at a loss, a desire which, at the stage now reached, appears to have little chance of being gratified. Instances in other directions are also quoted.

Chloride Welfare Work.—In our last issue we briefly mentioned a booklet which the Chloride Electrical Storage Co., Ltd., has produced, containing a description of its welfare arrangements. A better idea of these can be gained from the accompanying picture which, however, only represents one branch of the work. It shows the new cloakrooms and ablution rooms at the Clifton Junction works. In the centre foreground is seen a glass case containing tooth-brush racks (all

Chloride Cloakrooms and Ablution Rooms.

numbered) and special jets of water for dental cleansing. At the rear are the washing troughs. The cloakrooms are expanded metal enclosures, each with accommodation for 20 people's clothes. In accumulator manufacturing cleanliness is, of course, of paramount importance as a preventive of lead poisoning; the company's arrangements in this respect appear to be complete.

Glass v. Porcelain.—In the course of the annual report of the French Société des Porcelaines et Appareillages Electriques Grammont, it is stated that the year 1925-26 was characterised by a material slackening in the production of electro-technical porcelain, which is the principal branch of the company's activity. The diminution is attributed to the circumstance that glass is increasingly tending to replace porcelain for the equipment of high-pressure lines.

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Dutch Foreign Radio Trade.—From figures published in the *Wireless Trader* it is seen that the imports of radio apparatus into Holland last year were valued at £204,300, as compared with £100,330 in 1924. Germany was again the largest supplier with a share valued at £67,025, but Great Britain followed very closely with £63,390. Dutch radio exports rose from £33,225 in 1924 to £72,465 in 1925. Great Britain's share increased from £13,000 to £44,380 and that of the Dutch East Indies from £5,290 to £11,570.

A New Zealand Cable Contract.—*Tenders* records that the Auckland Electric Power Board, N.Z., recently accepted the tender of a British firm for the supply of cable. "Subsequently a request was made by the tenderer to sublet the contract owing to a breakdown in its vulcanising plant. The name of the firm to whom it was proposed to sublet the contract was given as that of Gaiepel. The Board refused the request."

New Municipal Showrooms and Offices.—New showrooms and offices for the Hebden Bridge Urban District Council's electricity undertaking were opened on November 9th by Councillor G. Atack, J.P. For the first week the showrooms have been arranged as an all-electric house, and during the second week there will be special demonstrations of electric cooking.

Advertising "Nesco" Electrical Service.—The Newcastle-upon-Tyne Electric Supply Co., Ltd., never neglects an opportunity of bringing its service before the public. The accompanying illustration goes to prove this. The time spent upon building construction brings no extra revenue, and it is advisable to offset any loss if possible. Therefore the company has taken advantage of the erection of its new headquarters, Carliol House, to draw attention to its service by means of an

We regret our encroachment on the footpath.
We hope our service in this building will more than compensate you for any temporary inconvenience.
NESCO ELECTRIC SERVICE

A "Nesco" Hoarding.

appropriate hoarding. This measures 18 ft. by 12 ft., and expresses the company's regret at its encroachment upon the public footpath and promises future compensation. Beneath the notice is a list of the company's various departments (hardly visible in our reproduction) and through each passes a line from the existing department, shown on a map to the left, to the new Carliol House on the right. This indicates the future concentration of the company's business organisation under one roof.

New Swiss Company.—Under the auspices of the Motor Columbus Co., of Baden, the North-Eastern Swiss Power Works Co., of Basle, the Rheinfelden Power Transmission Co., and the Baden Provincial electric supply undertaking, a new company has just been formed at Rheinfelden with a capital of £1,200,000 to build and operate the new Ryburg-Schworstadt hydro-electric power station on the Rhine.

Franco-German Aluminium Negotiations.—In interested German circles it is stated that the recent discussions between representatives of German aluminium producers and of the French works have led to a fundamental agreement for co-operation of a lasting character. In the first place there is to be a constant interchange of experience in the matters of production and sales organisation, and mutual support is to be given in regard to sales propaganda. On both sides the willingness is said to exist to come to an understanding in future in respect of common questions and no longer to work against each other. It is proposed periodically to repeat the discussions and on the next occasion to deal with matters individually.

Spanish Electrical Contracts.—Among the electrical engineering contracts recently secured by the Sociedad Iberica de Construcciones Electricas, of Madrid, is a third 14,060-kVA generator and seven transformers, of a total capacity of 47,430 kVA, for the Camarasa hydro-electric station, and a 17,000-kVA generator and five 6,250-kW transformers for the Sociedad Hidro-Electrica Espanola.

Zinc Consumption in Germany.—As a result of the development of radio in recent years there has been a great increase in the demand for, and output of, high-tension batteries in Germany. This increase in activity has had its effect on the zinc industry, it being estimated that no less than 2,500 tons of zinc is now annually required to meet the needs of battery manufacturers.

Proposed New Buenos Aires Subway.—The *Review of the River Plate* reports that recently a proposal signed by Dr. Celestino I. Marcó, in representation of Lord Ampthill and Major Orlando Sumner and of Messrs. Gandulfo & Co., for the construction of an underground system of tramways was presented to the Secretariat of the Deliberative Council. The following particulars relative to this proposal appeared in the local Press:—"The persons named and the signatory of the proposal form a provisional syndicate which would be constituted formally once the Deliberative Council had decided favourably regarding the concession asked for. The syndicate, according to the information given, has been constituted in London by two groups; one a financial group headed by Lord Ampthill and comprising several British banks and other institutions, the other group consisting of technical constructors under the presidency of Major Orlando Sumner. This second group comprises the constructors of the existing underground systems in London, Engineers Haley and Mayho and also the chief (?) of those railways, Engineer Dalrymple. Once the concession was obtained the company would be formed on an Anglo-Argentine basis, for which purpose part of the capital would be subscribed here. The system of construction would be identical with that employed in London, that is to say, in the form of underground steel tubes not necessitating the opening up of any streets. A concession is asked for a term of ninety years for the construction and working, at a tariff of 10 cents per passenger for direct journeys, and 15 cents for combination journeys, of an underground system of communications."

German Joint Organisation for Export Trade.—A group of firms engaged in the production of special manufactures have formed a joint organisation for the representation of their sales interests in connection with securing foreign orders. The firms concerned are Voigt & Haeffner, the Maffei-Schwartzkopff Works, the Lloyd Dynamo Works, the firm of Dr. Max Levy, the Dr. Paul Meyer Company, the Poege Electricity Company, and the Saxony Works of Niedersedlitz.

The Palestine Electric Corporation.—It is reported that Sir Hugo Hirst, Bt., and Dr. A. H. Railing have joined the board of the Palestine Electric Corporation, Ltd. Lord Reading is the chairman and Mr. Pinhas Rutenberg the managing director.

The Fair at Birmingham.—In the course of his presidential address to members of the Birmingham Chamber of Commerce last week, Col. Walduck said that the forthcoming British Industries Fair at Castle Bromwich would be half as large again as the Fair of 1926, and that the electrical section, which was a great success last year, would be substantially larger and even more representative of that industry.

The Brush Co-partnership Scheme.—A meeting of shareholders of the Brush Electrical Engineering Co., Ltd., was held on Monday last to consider the co-partnership scheme which has been drawn up by the board. The avowed object of the scheme is to give the employés a direct and continuing interest in the success of the company. Broadly, the project is to distribute any surplus which remains after meeting all charges and paying a dividend of 10 per cent. on the ordinary shares between the shareholders and the employés in proportion to the total salaries, wages and dividends paid for the year in question. The employés will thus receive the largest share as the amount of salaries and wages is about six times the amount paid in ordinary dividends. The shareholders have agreed to allocate the surplus for 1925 (£8,751) to the Co-partnership Fund and after the deduction of the proportion due to the shareholders under the scheme the remainder will be applied by the Co-partnership Council in subscribing for ordinary shares of the company at par, and the shares so subscribed for will be distributed, as at December 31st, 1926, to the employés. The shares will rank in every respect equally with the other ordinary shares, and, if he prefers, an employé may elect to take cash instead. The shares can be retained or sold by the employé, and advice on this matter will be given by the secretary or a member of the Council. The latter body will consist of eight members and a chairman. Two members will be elected by each of the three classes of employés, *viz.*, craftsmen and others on the time wages list; staff on the weekly wages list; and staff on the salary list. The remaining two members will be appointed by the board, and the chairman will be elected by the Council annually. After the second year half the members of the Council will retire and will be ineligible for re-election for a period of one year. The Council is empowered to recommend a maximum of ten rewards in any one year, each award not to exceed £5, for accepted suggestions from employés in any departments. A Provisional Council has been constituted under the chairmanship of Mr. E. Garcke. The meeting approved the scheme and confirmed the appointment of the Provisional Council.

New Italian Companies.—Among the new electrical concerns recently organised in Italy are the Società Industriale Elettrica del Vitulanese formed at Benevento with a capital of 200,000 lire; La Società Consorzio Consumatori Braidesi Energia Elettrica, of Bra, capital 115,000 lire; La Società Elettrografite di Marone, of Brescia, capital 50,000 lire; and La Società Elettromeccanica, of Legnano, capital 300,000 lire.

Trade Facilities Guarantees.—It is announced that the Treasury has sanctioned further guarantees under the Trades Facilities Acts amounting to £3,182,500, bringing the total up to the end of September to £67,985,780. Among the latest sanctions are the following:—North Wales Power Co., Ltd., £300,000; Electricity Distribution of North Wales and District, Ltd., £50,000; East Suffolk Electricity Distribution Co., Ltd., £20,000; and the Teignmouth Electric Lighting Co., Ltd., £12,500.

Social Events.—The Greater London Division of the Electricity Supply Commercial Association held a successful dance on November 2nd, at Cannon Street Hotel. The attendance, as compared with previous occasions, was rather disappointing, about 150 being present, and we cannot help feeling that the efforts of Mr. S. W. Turner, divisional secretary, and those who assisted him in organising the event were deserving of much better support. However, those who did attend had the advantage of more space to indulge in their favourite "stunts," and Adam's Syncopated Orchestra, which had wisely been re-engaged, saw to it that the feet of the company were not allowed to remain idle. The distribution of novelties added to the evening's enjoyment, and the catering arrangements, as usual, were excellent.

The Southport Corporation Tramway Employés' Athletic Society held a dance last week in aid of the fund for the premises which it has recently acquired as an Institute. The premises were opened by Alderman W. H. Potts (chairman of the Tramways Committee), who also presented a silver cup to the winner of the department's bowling tournament. The dance was attended by the Mayor and Mayoress (Councillor and Mrs. Hadfield) and a number of prominent local people.

Trade Announcements.—THE TUNGSRAM ELECTRIC LAMP WORKS (GT. BRITAIN), LTD., has opened a branch office and stores at Milburn House, Newcastle-on-Tyne (agent: Mr. R. F. Sunderland).

The name of the PARSONS MOTOR CO., LTD., has been changed to The Parsons Oil Engine Co., Ltd. The alteration is consequent upon the development of the company's oil and petrol engines for marine and stationary work, and there will be no change in constitution or policy.

MESSRS. BRUCE PEEBLES & CO., LTD., of Edinburgh, have appointed Messrs. Sellar & Fraser, of 144, St. Vincent Street, Glasgow, as their agents for the West and North of Scotland.

THE SHEFFIELD ELECTRICAL STORES has opened a depôt at 176, Norfolk Street, Sheffield, for the wholesale supply of electrical materials. Large stocks are held.

THE LONDON ELECTRIC WIRE CO. & SMITHS, LTD., have appointed Mr. Robert Garmany, Union Chambers, 1, Union Street, Belfast, sole agent for "Lewcos" products in Northern Ireland. He will carry large stocks of cotton, silk, and enamelled wire, fuse wire, resistance wire, and radio products.

Catalogues and Lists.—THE EDISON SWAN ELECTRIC CO., LTD., 123-5, Queen Victoria Street, E.C.4.—Seven illustrated price lists, dealing respectively with silk shades, batteries (dry and fluid), accumulators, heating and cooking apparatus, lighting fittings, electric lamps, and radio apparatus. Also an abridged net price list of rubber-insulated wires, cables, and flexible cords.

MESSRS. FRANK WIGGLESWORTH & CO., LTD., Clutch Works, Shipley, Yorks.—A brochure dealing with "Texrope" drives.

MESSRS. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.1.—November accessories list, containing details and prices of electrical machinery, apparatus, and accessories, including domestic appliances.

MESSRS. L. MCMICHAEL, LTD., Wexham Road, Slough, Bucks.—A November blotter advertising the company's seven-valve super-heterodyne receiver.

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—November blotter advertising the company's 3-phase bar coal cutter.

MESSRS. R. A. LISTER & CO., LTD., Dursley, Gloucestershire.—An illustrated and priced booklet describing the "Lister" 1½-kW electric lighting plant.

THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—November blotter, depicting the company's new wash boiler.

THE ENGINEERING AND LIGHTING EQUIPMENT CO., LTD., Sphere Works, St. Albans, Herts.—An illustrated booklet dealing with the "Sunrae" carbon arc (ultra-violet) lamp; folders describing "S.L.R." reflectors and "Lumax" lighting units (opal glass); and List No. P.1223, giving illustrations and prices of industrial lighting fittings.

THE RUNBAKEN MAGNETO CO., Tipping Street, Ardwick, Manchester.—An illustrated folder describing the "Runbaken" spotlight and portable lamp.

THE BASTIAN METER CO., LTD., 58, Haymarket, S.W.1.—Leaflet 14/50-51, giving details and prices of "Bastian" d.c. meters.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—A brochure illustrating a number of the company's manufactures.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Leaflet S.4283, containing revised prices of the articles listed in the company's electric lighting supplies catalogue S. (1); and Booklet W.4188, describing the "Magnet" c.t.s. wiring system.

THE MIDLAND ELECTRIC MANUFACTURING CO., LTD., Barford Street, Birmingham.—A descriptive folder dealing with a new range of small-size distribution boards rated at 15 A and 250 V. Priced.

THE UNDERFEED STOKER CO., LTD., Africa House, Kingsway, W.C.2.—A diagrammatic folder describing the "Beaumont" system of coal handling.

THE FOOLPRUFE PATENT ACCUMULATOR CO., LTD., Market Harborough.—A catalogue of "Lion" Planté-type accumulators and a showcard, a pamphlet, and a window transparency advertising these.

MR. E. J. BATT, 157, Dunstable Road, Luton.—A mailing card advertising a radio consulting service.

THE UNIVERSAL MANUFACTURING CO., 3, The Grove, Blackheath, S.E.10.—A card depicting the firm's enamels in eight colours.

THE BILLING TOOL CO., 101, Clerkenwell Road, E.C.1.—Clearance List No. 45, a priced catalogue of machine and hand tools of all kinds.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—November stock list of dynamos and motors.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—Monthly general price sheet for November. Illustrated.

Bankruptcy Proceedings.—H. ROBINSON, 41, Wigan Lane, Wigan, electrician and radio and cycle dealer.—The public examination of this debtor was held recently at the Court House, Wigan. The statement of affairs showed gross liabilities of £450. Debtor stated that he had had experience of the electrical trade, but not of the cycle business. In May, 1925, he commenced his present business with £210 capital, but the concern was never successful, and about two months later he borrowed £100 from his sister to buy stock. He began to sell cycles on weekly payments, but he had not sufficient capital with which to carry on, as customers did not keep up their payments. The examination was closed.

JACOB SEGAL, gas and electrical accessories merchant, 2, Vine Street, Tooley Street, S.E.—Under a receiving order made in this case on September 2nd, on the petition of Barclay's Bank, Ltd., the first meeting of the creditors was held last week at Carey Street, W.C. It appears from statements that have been made by the debtor that he came here from Russia in 1900, and a few years ago took out papers of naturalisation. At the present time he was acting as buyer to a limited company which was formed some 12 months ago in order to take over the assets and liabilities of the business of a wholesale gas and electrical accessories merchant which he had conducted at the above address. His remuneration was fixed at £500 a year, and his liabilities consisted of guarantees which he had been called on to liquidate, the chief being to the petitioning creditors for a sum of £2,000. In addition, he was liable in respect of a bank overdraft amounting to £800 in favour of another person who had disappeared. The debtor, who roughly estimated his liabilities at £2,000, attributed his failure to his liability as guarantor, and he had as assets a few shares in a limited company. The meeting passed a resolution for the appointment of Mr. C. Latham, 78, New Oxford Street, W.C., as trustee of the estate.

R. V. G. SELLERS (WIRELESS SUPPLIES AND INSTALLATIONS), wireless engineer, Town Hall Buildings, Banbury.—First meeting held November 11 at 37, Cornmarket Street, Oxford. Public examination, November 12th, at the Town Hall, Banbury.

W. R. SQUIRE, electrical engineer, 11, Steward Street, Spring Hill, Birmingham.—Supplemental dividend of 10s. 4d. in the £, payable at the Official Receiver's office, 191, Corporation Street, Birmingham.

E. G. BATT, electrical engineer, 20, Iverna Gardens, Bayswater, W.—Receiving order made November 2nd on creditor's petition. First meeting, November 16th; public examination, January 26th, 1927, both at Carey Street, W.C.

R. L. BROCK (R. L. Brock & Co.), electrical engineer, 5, Bedford Row, Tavistock Road, Plymouth.—Receiving order made November 2nd on creditor's petition.

W. HEANEY, electrician, 12, Market Place, Henley-on-Thames.—Receiving order made November 1st on creditor's petition.

A. H. DUFFIN and G. KERSHAW (A. H. Duffin & Co.), electrical engineers and contractors, Provincial Buildings, Conway Road, Colwyn Bay.—Trustee, Mr. P. W. Aston, Mostyn Chambers, Conway Road, Colwyn Bay, released September 28th.

Company Liquidations.—BRITISH ELECTRIC VEHICLES, LTD., 36-7, Old Jewry, E.C.—Under a compulsory winding-up order made against this company last April on a creditor's petition, accounts have been lodged showing total liabilities of £33,023, of which £12,191 is unsecured; assets valued at £20,831, but absorbed by the preferential claims (£355) and loans on debentures (£26,333); and a total deficiency of £13,191 with regard to contributories, the issued capital being £1,000 in ordinary shares. Mr. E. T. A. Phillips, Official Receiver, reports that the company was incorporated in 1916 with a nominal capital of £5,000, under the name of "British Miniature Electric Vehicles, Ltd.," and its name was changed to "British Electric Vehicles, Ltd." in 1918. The company was formed to acquire and develop an agency business connected with the manufacture and sale of miniature motor vehicles, including bath chairs. Shortly after its formation, and in view of the war, the manufacture of motor bath chairs was abandoned by the company, and steps were taken to introduce small electric motor vehicles, such as trolleys and trucks. Subsequently much larger vehicles, including electric locomotives, were manufactured. It raised a total of £27,000 on debentures. Except during the

year ended March 31st, 1920, when a profit of £1,332 was made, the company's business was carried on at a loss, and on March 31st, 1922, the accrued loss amounted to £4,226. On September 5th, 1922, the company being unable to discharge the interest due on its debentures, the trustees for the debenture holders appointed Mr. A. S. Sinclair as receiver of the company's property, with power to carry on its business. Shortly after the appointment of the receiver, a petition for the winding up of the company was presented to the Court, but it was dismissed. The business was carried on by the receiver, with the approval of the trustees for the debenture holders, from the date of his appointment until shortly after the date of the winding-up order. Heavy losses were incurred, and as the receiver, prior to the presentation of the petition on which the winding-up order was made, was acting as the agent of the company, the debts incurred by him in that capacity were, strictly speaking, unsecured debts of the company. The debenture holders did not desire to take advantage of their strict rights, and they had agreed to the payment of the unsecured debts incurred during the receivership in priority to their own claim against the company's assets. The unsecured trade debts created during the receivership amounted on March 31st, 1926, to £3,807, in addition to a bank overdraft of £3,937. The receiver has sold the stock-in-trade and machinery, and is taking steps to realise its other assets. It is not anticipated, however, that his total realisations will produce sufficient to meet the debenture holders' claim for principal and interest, even without taking into account the unsecured debts incurred during the receivership. The total unsecured indebtedness of the company is put at £6,335. There is no prospect of the payment of a dividend to the unsecured creditors whose debts were outstanding at the date of the appointment of the receiver. The failure of the company is attributed by the directors to insufficiency of demand for its manufactures to enable it to meet overhead expenses, Home and foreign competition which necessitated production at a small margin of gross profit, and to the fact that the demand for electric vehicles has been more for types of special design than for types of one standard, thus largely increasing the cost of production.

First meeting of creditors, November 15th, at Carey Street, W.C.

AGRICULTURAL ELECTRIC DISCHARGE CO., LTD.—Winding up voluntarily. Liquidator, Mr. W. F. Newman, 51, Great Charles Street, Birmingham. Meeting of creditors, November 15th, at the offices of the company, 51, Great Charles Street.

SELLING WIRELESS, LTD.—Winding up voluntarily. Liquidator, Mr. J. A. Couper, 17, East Parade, Leeds.

SPRINGFIELD ELECTRIC MOTORS, LTD.—Mr. V. Dalton, 26, Bond Street, Leeds, the liquidator in the voluntary liquidation of this company, has issued a report showing that the realisation of the assets permits of the payment of a first and final dividend of 1s. in the £.

Studying the Canadian Market.—The necessity for British manufacturers to adjust their views when dealing with Canada is stressed in a recent article in the Toronto *Financial Post* (quoted by *Reuter*). It states that many manufacturers expect the Canadians to take their goods as they stand, whether the Canadians consider them suitable or not; indeed, they often express indignation if alterations are suggested. Our contemporary says:—"British manufacturers who come to Canada and hope to sell their goods here because they think 200 years in business, or their Royal Warrants, will impress the Canadians and make them buy rather than be sold, are doomed to disappointment." The article concludes with the words:—"British firms that have gone about their selling in Canada properly have numbered a high percentage of successes."

Copper, Lead and Rubber Prices.—Messrs. F. Smith & Co. report, November 9th:—Copper (electrolytic) bars, £66 5s., 15s. dec.; ditto, ditto sheet, no change; ditto, ditto wire rods, £76 5s., 10s. dec.; ditto, ditto H.C. wire, 9 9/16d., 1/16d. dec.; silicium bronze wire, 10¾d., ¼d. dec.

Messrs. James and Shakespeare report, November 9th:—No change in the prices of copper bars (best selected), sheet and rod; English pig lead, £30 10s., 10s. dec.

Messrs. Edward Till & Co. report, November 9th:—No change in the price of india-rubber, Para fine.

An F.B.I. Forecast.—In its forecast for the fourth quarter of 1926, the Federation of British Industries says that the obscurity of the international trade position has been deepened by the continuance of the coal stoppage into the time of year when normally preparations are made for replenishing raw material stocks and placing long-term contracts. The stoppage must seriously interfere with these operations, and involve some modification of previous estimates of the magnitude and quality of the revival of trade expected to follow a settlement. It is no longer possible to assume that all industries will participate in the movement to the same extent as they would have done had there been an earlier settlement, as it is probable that certain of the changes in the trend of our trade as a whole and in the future relative level of prosperity of the component industries will have been accelerated. The position in regard to world prices is that the trade cycle depression which has been in progress for the greater part of the year still continues While under more stable monetary conditions it might be expected to give way at an early date to an expansion of trade, the adverse influences referred to above impose serious obstacles; and some further liquidation in America appears to be called for.

Belgian Duties Increased.—*Reuter's Trade Service* reports that a number of increases in the Belgian import tariff were put into force on November 2nd. Among the articles affected are electric cables.

The *Board of Trade Journal* states that the "coefficients" on machinery have been raised.

Book Notices.—"Pitman's Engineering Educator."—This work, edited by Mr. W. J. Kearton, M.Eng., is being published in 30 fortnightly parts by Sir Isaac Pitman & Sons, Ltd. The first three parts have been issued and No. 4 will be ready on November 6th. It is prepared along similar lines to "Pitman's Electrical Educator," which is nearing completion. It is intended primarily for the mechanical student and contains the necessary subjects, including mathematics, mechanics and machine construction, apart from specialists' subjects, written in lessons by various experts. A contribution of particular interest to electrical men is Electro-Technics for Mechanical Students, by A. P. Young, O.B.E., M.I.E.E. A number of special articles are appearing with the lessons from time to time by distinguished engineers, including Sir Robert Hadfield, Bt., M.A., Prof. W. H. Watkinson, M.Eng., Prof. F. C. Lea, M.Sc., Mr. J. Swinburne, M.Inst.C.E., and Mr. John Goodman, M.Inst.C.E.

"The Way to True Radio Reproduction" (24 pp., ill.). Hollinwood: Ferranti, Ltd. Price 1s.—This brochure contains useful information regarding the correct operation of radio receiving sets. It is divided into two parts addressed respectively to constructors who are not concerned with radio-technology and to those of a scientific bent.

"Surface Water Supply of Canada: Arctic and Western Hudson Bay Drainage (and Mississippi Drainage in Canada) in Alberta, Saskatchewan, Manitoba, and Western Ontario, Climatic Year 1923-24" (pp. 220 and map). Ottawa: F. A. Acland, Government Printer.

Chinese Notes.—The Pootung Electric Supply Co. (Shanghai) reported a net profit of $29,486 for 1925. A final dividend, making 8 per cent. for the year, was declared. The company is an entirely Chinese concern with a paid-up capital of $300,000.

The construction of the new waterworks of the Chapei Electricity & Waterworks Co., Ltd., has been commenced. The pumps will be electrically driven. The company will at first take its electricity requirements from the Shanghai Municipal Council, but it intends eventually to erect a power station of its own.

During the past year or two a number of temporary and permanent radio stations have been erected in Manchuria, most of them being capable of communicating with Europe and America. A broadcasting service is being planned. Dealers in radio apparatus have to deposit $1,000 with the authorities and apparatus is subject to a 10 per cent. *ad valorem* import duty.

Construction work on the Harbin tramway commenced during the summer. The materials are being supplied by the Siemens (China) Co., and the principal contractor for the work is the An Tai Co., which built the Peking tramway. The funds are being provided jointly by the provincial government and the principal merchants.

A long-distance telephone service between Shanghai and Sungkiang was completed during September, but owing to disturbances has so far been used solely for military purposes.

The Ta Tung Electric Co. is being organised in Shunking, Szechwan province.

In the same province, in Changshow, a company is being formed to generate electricity by means of local waterfalls.

The Hwan Chiu Battery Factory, established at Hangchow, Chekiang province, commenced operations in July last.

For Sale.—Mr. H. J. Shaw will sell by auction, on November 17th, at 77, Chancery Lane, W.C.2, a stock of wireless and electrical goods. Edinburgh Corporation Electricity Supply Department invites offers for about 23 tons of scrap copper wire. (See our advertisement pages to-day.)

Italian Electrical Industry Active.—Machine shops and foundries in Italy producing material for hydro-electric plants are busy, and the outlook for continued employment and production in these lines is good. Italian companies furnishing hydro-electric material are prosperous and active. The favourable conditions affect also plants producing electric cables and conduits. The extension of telephone lines in Italy will increase the manufacture of electrical apparatus.—*Commerce Reports.*

The Business Research Association.—The second meeting of the 1926-27 session of the Business Research Association of Great Britain was held on October 27th at the Old Colony Club, W.C.2. Mr. J. C. Kirkwood delivered an address on "Some Practical Results of the Application of Business and Market Research" at a well-attended meeting, and an interesting discussion followed. The paper covered a wide range dealing with budgetary control, market studies, advertising research, *personnel* research and standardisation, and speakers emphased the value of Mr. Kirkwood's address in that its accent lay on actual research results of commercial value to manufacturers and other business men. The keynote of business research was value, and once general business realised that its utility lay in increasing efficiency and eliminating wasted effort and wasted time, the practice of business research would become an accepted part of everyday business. The next meeting will be held at the Old Colony Club on November 24th, when Mr. R. N. Ahern, managing director of Burroughs Calculating Machines, Ltd., will deliver an address on "Research in Business Finance."

Lighting and Power Notes.

Aberdeen.—YEAR'S WORKING.—The report on the working of the city electricity undertaking (engineer: Mr. J. A. Bell) for the year ended July 31st last shows a total income of £196,108, as compared with £198,502 in 1924-25. Working expenses amounted to £105,096, as against £106,005, leaving a gross profit of £91,012 (£92,497). Interest and sinking-fund charges absorbed £80,027, and there was a net profit of £10,985, which was placed to reserve. The previous year's working resulted in a surplus of £23,357. The capital expenditure during the year amounted to £114,175, the chief items being £43,822 for machinery and £37,506 for mains and services. The sales of electrical energy increased from 26,458,959 to 26,779,912 kWh. During the year an order was placed for a second 10,000-kW set, which it is hoped will be in operation by the winter of 1927. The Maberly Street sub-station was completed, the plant installed including a new 1,000-kW converter and two 500-kW converters transferred from George Street sub-station. The change-over from d.c. to a.c. in the Deeside area was also completed during the year.

Ashton (S.W. Lancs.).—LOANS.—The Urban District Council is to apply for sanction to borrow £4,000 for mains and services and £200 for electricity meters.

Australia.—BRISBANE (Q.).—A *Reuter* message from Brisbane reports that the City Council has decided to proceed immediately with the erection of a new power station, at an estimated cost of £357,000.

Beckenham.—NEW PLANT.—The Electricity Committee has recommended the installation of an additional 3,000-kW set at the power station, at an estimated cost of £33,000.

Connah's Quay.—LOAN.—The Urban District Council is applying for sanction to a loan of £3,500 for electricity purposes.

Continental.—SWITZERLAND.—The North-East Swiss Power Works Co. has received Government authority to export electricity to Germany to the extent of 60,000 kWh daily during the whole of the year.

FRANCE.—The Paris-Orleans Railway Co. has recently secured official authority to proceed with the erection of a 150,000-V transmission line and two 90,000-V lines between the new power station at Eguzon and Chevilly, near Paris.

ICELAND.—The question of the utilisation of the water powers in Iceland, which are claimed to represent between 5,000,000 and 6,000,000 h.p., has been under consideration for many years past. It is now announced from Copenhagen that the Icelandic Alting has adopted a concession law, authorising the Government to grant concessions to the Salt og Kemiske Fabrikker and the Dansk-Islandsk Anlagsselskab for the establishment of hydro-electric works on the west coast. The companies have acquired rights at the Arnefjord for industrial establishments, it being intended to utilise up to 40,000 h.p. in connection with the production of iron and aluminium from native ores and for other purposes.

Coulsdon.—STREET LIGHTING.—The Urban District Council is considering the advisability of lighting the streets by electricity instead of gas, and it is proposed that test lamps shall be erected by the County of London Electric Supply Co., Ltd.

Frome.—ELECTRICITY SUPPLY.—Messrs. M. Partridge and Co., Ltd., of Exeter, have informed the Rural District Council that they propose to erect a power station at Clifford Mill to supply electricity to the villages of Beckington and Rode. The support of the Council is requested for an application for a Special Order, for sanction to erect overhead mains, and for consent to commence a supply of electricity as an unauthorised undertaking until the Special Order is granted. The Council has replied that it will do all it can to facilitate the scheme when the Order has been obtained.

Guildford.—ELECTRICITY IN BULK.—The Town Council has received a request from Aldershot Corporation for terms for a bulk supply of electricity, and has replied that it will be prepared to give a bulk supply as soon as practicable.

Heckmondwike (Yorks.).—YEAR'S WORKING.—At a recent meeting of the Urban District Council it was reported that the figures of the last year's working showed a record profit of £4,141. The year had been the first full year of the new policy of distributing electricity bought in bulk instead of the former method of generating locally, and the charge for lighting had been reduced by 2d. per kWh. The wiring scheme had resulted in 526 new consumers being connected up since the beginning of the year.

Japan.—ELECTRICAL DEVELOPMENT.—According to *Eastern Engineering*, the construction of the 30,000-kW sub-station of the Toho Electric Power Co. at Nishi Biwajima, a suburb of Nagoya, is proceeding rapidly. There will be four transformers, each of 7,500-kW capacity. Part of the plant has already been installed, and the station will be completed before 1927. This station will receive electricity supplied by the Daibo, Ibi, Nagaragawa, and Nohi Electric Power Companies, and by the Hayakawa Water Power Co., for distribution to other sub-stations in the city. The Nippon Denryoku Kaisha's power house at Amagasaki is being extended to 90,000 kW, at a cost of 12,000,000 yen. The work will be completed, it is expected, by March next year. The energy generated will be transmitted to the transforming station in Osaka. The extension will be carried out with a view to meeting any breakdown of the hydro-electric power stations in the neighbourhood of Osaka.

London.—BERMONDSEY.—The Electricity Committee has received sanction to a loan of £10,750 for electricity extensions.

Lytham-St. Annes.—PRICE REDUCTION.—The Town Council has reduced the charge for electricity on the combined system from 20 per cent. of the net rateable value of premises, plus 1d. per kWh, to 15 per cent., plus ½d. per kWh.

Mexborough.—INQUIRY.—The Electricity Commissioners will hold an inquiry on November 16th into the application of the Urban District Council for sanction to borrow £20,000 for extensions to the generating station.

New Zealand.—LAKE COLERIDGE.—The report of the Lake Coleridge hydro-electric undertaking for the year ended March 31st last shows a total revenue of £123,355 and working expenditure of £27,035, leaving a gross profit of £96,320. After providing for capital charges, there was a net profit of £26,646, as compared with £5,434 in the preceding year. The electrical energy sold increased from 51,287,033 to 60,668,125 kWh, and the maximum supply demanded from 13,180 to 14,430 kW. Work was commenced during the year on extensions to the station to accommodate two 7,500-kW sets, and one is now in operation. A transmission line is being erected between Timaru and Camaru, which will eventually work at a pressure of 110,000 V.

WAIKATO (HORAHORA).—The accounts of the Horahora undertaking for the year ended March 31st last show a total income of £85,830, from which were deducted working expenses (£19,612), interest (£31,269), depreciation (£13,601), and sinking-fund charges (£11,342), leaving a net surplus of £10,006. The sales of electrical energy increased from 41,281,159 to 60,261,326 kWh, and the maximum supply demanded from 8,300 to 11,860 kW. The capacity of the station was increased during the year to 10,300 kW by the addition of two 2,000-kW sets, and a supply was commenced to the Franklin, Auckland, and Waitomo Power Boards. A 110,000-V transmission line from Claudelands to Penrose was completed, and additional 50,000-V lines were erected to serve three other districts.

MANGAHAO.—The report on the Mangahao undertaking covers the first completed year to March 31st last. The total revenue amounted to £76,859, and after meeting working expenses (£21,865), interest (£92,226), and depreciation (£30,056) there was a net loss of £67,288. The consumption of electrical energy amounted to 45,131,120 kWh, and the maximum supply demanded to 13,960 kW. Owing to the increasing load on this undertaking, work has commenced on the construction of the main power station at Waikaremoana; the initial plant will include two 20,000-kW sets.

Price Increases.—Owing to the higher cost of coal, increases in the charges for electricity have been made or recommended in the following districts:—

LEIGH (LANCS.).—Lighting and power: An increase of 10 per cent.

OKEHAMPTON.—Lighting: From 8d. to 10d. per kWh. Power: An increase of 25 per cent.

STEPNEY.—An increase of 10 per cent.

MANCHESTER.—All energy not subject to a sliding scale for price of coal: An increase of ¼d. per kWh.

COLCHESTER.—A further increase from 10 to 15 per cent.

Reigate.—ELECTRICITY IN SMALL HOUSES.—The Town Council is to supply electricity to the Council houses to be erected on the Ringwood Avenue site, and has decided to have drawn up a provisional form of contract for a rental wiring system. Tenders are to be invited from local electrical contractors for wiring.

Seaham Harbour.—OPPOSITION TO SCHEME.—The local Gas Company has lodged objections to the application of the Urban District Council for an Electricity Order on the ground that the company meets all requirements so far as lighting is concerned, and that the proposed scheme would not be a paying one.

South-East Lancashire Electricity Advisory Board.—BULK SUPPLY TO ROCHDALE.—The Engineering Advisory Committee has recommended the Board to approve the proposed contract for the Lancashire Electric Power Co. to give a bulk supply to Rochdale, subject to an amendment that the maximum demand does not exceed 23,000 kW.

MACCLESFIELD.—The Committee has also recommended that the installation by the Electricity Company of Macclesfield, Ltd., of a 400-kW set be approved, but that the company be requested to consider the advisability of taking a bulk supply for the whole of their requirements in the future, and the changing-over of the distribution system to a.c.

The Board has approved and adopted the minutes of the proceedings of the Engineering Advisory Committee, and has instructed it to approach the Corporations of Salford, Manchester, and Oldham to ascertain whether they would be willing to extend their power stations to meet all or any of the demand, which it is proposed should be met by the erection of a power station at Kearsley by the Lancashire Electric Power Co., and upon what terms they would be prepared to furnish such a supply.

South Shields.—ASSISTED WIRING SCHEME.—During the quarter ended September 30th last 971 additional consumers were connected to the Corporation's electricity supply system, under its assisted wiring scheme, making a total for the current year of 2,768. The total since the inauguration of the scheme is 9,873.

Special Orders.—Application has been made to the Electricity Commissioners by the Power Development Co., Ltd., for a Special Order authorising it to supply electricity in the

urban district of Yeardsley-cum-Whaley, the rural district of Disley, and certain parts of the rural districts of Chapel-en-le-Frith and Macclesfield.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them to the Midland Electric Light & Power Co., Ltd., for the supply of electricity by the Leicestershire and Warwickshire Electric Power Co., in parts of the rural districts of Rugby and Lutterworth.

Torquay.—LOANS.—The Town Council has applied for sanction to loans of £12,500 for mains and services and £9,620 for expenditure on additional h.p. and l.p. mains laid during the past year.

Wetherby.—ELECTRICITY SUPPLY.—Although the Electrical Distribution of Yorkshire, Ltd., only recently received powers to supply electricity to a number of villages in the Wetherby area, such progress has been made that a supply will be available next month. The villages in which mains are being laid are Bardsey, Boston Spa, Bramham, Clifford, Collingham, East Keswick, Linton, Rigton, Thorp Arch, Thorner, and Wetherby. The scheme involves the erection of ten miles of overhead lines and a similar length of underground cables. The company is to open offices and showrooms at Wetherby.

Tramway and Railway Notes.

Australia.—NEW SOUTH WALES.—The report of the Railway Commissioners of New South Wales on the working of the tramway system for the year ended June 30th last shows a total income of £3,619,496, an increase of £224 as compared with the previous year. Working expenses rose from £3,174,862 to £3,319,996, the increase being due to higher wages and the introduction of a 44-hour week. The gross profit was therefore £299,500, as against £444,410. Capital charges absorbed £577,900, and there was a net loss of £278,400, as compared with a loss of £102,079 in the preceding year. The railway system also showed a deficit of £830,671, making a net total loss for the whole of the undertaking of £1,109,071.

Cardiff.—TRAMWAY EXTENSIONS.—According to the *Times Trade and Engineering Supplement*, the City Council has decided to enlarge its scheme of tramway extensions by including the Victoria Park to Ely extension, which was to have been deferred pending road and bridge widenings. This extension was regarded as most essential in view of the development of Ely as a new suburb by the housing schemes of the council. The total cost of the extensions approved—Whitchurch Road to Gabalfa, Cathedral Road to Llandaff Fields, Moira Place loop, and Victoria Park to Ely—is estimated at £112,689 for the double tracks and overhead equipment, exclusive of the cost of road and bridge widenings. A provisional order is to be applied for forthwith.

Continental.—BAVARIA.—In a recent issue of *Elektrotechnik und Maschinenbau*, some details of the results obtained during the first year of the working of the electrified railways in Bavaria are given. During 1925 the lines converted to electric traction were those between Munich and Garmisch (62¼ miles), Tutzing and Kochel (20 miles), Munich and Gauting (12 miles), Weildheim and Teissenberg (5¼ miles), and between Munich and Hersching (24 miles), bringing the total length of the electrified system up to 174 miles. During the first twelve months 25 million kWh was used for a train mileage of 1,730,625,000.

ITALY.—The Minister of Public Works has recently opened the new electric line between Spoleto and Norcia. The line is 51 km. in length and the work of construction has necessitated the boring of 20 tunnels, the construction of 15 viaducts and other important engineering works. There are eight stations on the line and the whole work has cost approximately 50,000,000 lire. All the rolling stock and the electrical and engineering material were supplied by Italian works.—*Reuter's Trade Service* (Milan).

Douglas (I. of M.).—ELECTRIC 'BUSES.—The Corporation has instructed the tramway manager to obtain information regarding accumulator electric 'buses for running on the promenade.

Heywood.—NEW ROUTE.—Intimation has been received by the Town Council that the Unemployment Grants Committee is prepared to consider as an unemployment scheme, the proposed tramway between Heywood and Middleton, if formal application is made. The General Purposes Committee has decided to proceed with the application.

London.—PASSIMETERS AT VICTORIA.—The passimeter system of booking will shortly replace the present booking office at Victoria Underground station. The three booking booths have already been erected and 20 automatic ticket machines are to be installed. Over 21 million passengers used this station last year.

BREAKDOWN.—A breakdown, caused by the displacement of a conductor rail, resulted in the closing down of the Waterloo to City tube of the Southern Railway on November 5th. Repair work was immediately commenced and the line was reopened on the following day.

Swansea.—MUMBLES RAILWAY.—The *Times Trade and Engineering Supplement* reports that the work of electrifying the Swansea and Mumbles Railway is expected to be commenced shortly. The work is still held up owing to the mining dispute, but it is hoped that it will be completed by next summer. The line, which is six miles in length, is leased by the Swansea Improvements & Tramways Co., and the electrical energy required will be supplied by Swansea Corporation. A 20 minutes' service is proposed.

York.—RAILLESS CARS.—The Tramways Committee has recommended to the Corporation that application be made to the Minister of Transport for sanction to extend the railless-car system from East Parade, Heworth, to the new Corporation housing estate at Tang Hall.

Telegraph and Telephone Notes.

Atlantic Cables.—CONFERENCE.—Mr. Newcomb Carlton, president of the Western Union Co., arrived at Southampton on November 5th from New York. He is to attend a conference of various cable companies in England, the purpose of which will be to discuss means to expand business.

Canada.—SECOND IN TELEPHONES.—At the annual meeting of the Telephone Association of Canada, Mr. P. A. McFarlane, president, stated in his report that Canada stood second only to the United States in the matter of telephone development. There were 1,072,454 telephones in service in Canada, an increase of 170,364 in four years, while in the same period the number of employés had risen from 19,943 to 21,685. The total investment in telephones had risen from 158,678,229 to 193,884,378 dollars.—*Reuter* (Montreal).

Irish Free State.—AUTOMATIC TELEPHONY.—Dublin's first automatic telephone exchange, to serve about 1,600 subscribers, but with a capacity for 4,000 lines, will be opened early next year. The new exchange will give relief to the Central exchange, which has found great difficulty in meeting the increasing demands on its services. Six months later the Merrion exchange will be completed, and a third, to include all the centre of the city with Drumcondra and Clontarf, will follow. The authorities expect that in due course about 50,000 telephones will be working in the Dublin area. So far as is possible, Irishmen only are being employed in the work of installation.

Netherlands.—SHORT-WAVE RADIO COMMUNICATION.—Regular wireless connection between the Netherlands and Curaçao, Dutch West Indies, will be accomplished soon by means of short-wave transmitters, says *Commerce Reports*. Experiments conducted by the Technical Bureau of the Department of the Colonies have met with unusual success at night, and endeavours are now being made to establish satisfactory connection during the day. The Bureau is conducting similar experiments with a view to establishing communication between the Netherlands and the Netherlands East Indies.

Switzerland.—TELEGRAPH SERVICE.—The American "Teletyp" telegraph printing system has just been adopted in connection with the telegraph service between Berne and Biel, Switzerland. It is stated that the system enables 230 words per minute to be transmitted and printed over a distance of several hundred miles, and possesses several other advantages over the older Hughes system.

Transatlantic Telephony.—FINAL DETAILS.—Representatives of the American telephone companies are now in this country for the purpose of arranging the final details of a radio-telephone service between England and America. Test calls are being successfully transmitted at the rate of 50 or 60 per day, and it is not considered impossible that the service may be open for commercial use early in the New Year. The English station is the Government one at Rugby, where a 200-kW valve transmitter has been installed. The receiving station is at Wroughton, near Swindon, and the two are worked by land-line from the trunk exchange in London.

Radio Notes.

Australia.—NEW TASMANIAN STATIONS.—The new broadcasting station, 7ZL, which is to be built by the Tasmanian Radio Pty., will soon be under construction. The studio premises have been secured at Hobart, and the transmitting station will be on the higher levels out of the city. According to the *Electrical Engineer of Australia and New Zealand*, Mullard air-cooled transmitting valves will be used, each of 1,000-watt rating. A relay station is to be installed at Launceston to relay 7ZL programmes for northern listeners.

Canada.—TRANSMITTING STATIONS.—There are now 543 wireless transmitting stations in Canada. Of that number 67 are broadcasting stations, 356 are amateur and experimental, and 67 are code stations, while 46 are operated on the coasts and Great Lakes for the benefit of shipping. All broadcasting and other wireless in the Dominion is under the direction of the Dominion Government Department of Marine and Fisheries.—*Reuter* (Ottawa).

Holland.—WIRED-WIRELESS.—The much-discussed scheme of relaying wireless programmes by ordinary telephone, which was initiated some months ago by The Hague Municipal Telephone Service, was successfully inaugurated there on November 1st. It is claimed that this is the first occasion on which the ordinary telephone subscriber has been enabled to listen to wireless programmes without the assistance of a special wireless set. So far, arrangements have only been concluded with the Paris, Daventry, and Hilversum stations for the "transmission" of broadcasting programmes. A novel feature of the new service is that the ordinary telephone service is not in any way interrupted; as soon as a listener is called on the telephone, the wireless broadcasting connection is automatically disconnected.—*Reuter* (Rotterdam).

Hospital Installations.—*Daily News* FUND.—A luncheon was given on November 2nd, at the Mansion House, by invitation of the Lord Mayor, to celebrate the completion of the equipment of London hospitals with wireless installations through the funds raised by the *Daily News*. Since the fund was instituted in May, 1925, a total of 122 hospitals have been equipped, and 13,456 headphones and 479 loud-speakers provided, at a total cost of just over £25,000. In addition, advice and technical assistance has been given to 173 funds in the provinces.

Licences.—CONTINUED GROWTH.—In September, 1926, the number of broadcast radio receiving licences in force in this country was 2,105,000, an increase of 459,793 since December, 1925. The *Radio Times* points out that 34,230,000 of the population (in Great Britain only), or 79.74 per cent., are living within "crystal" range of a station. In three years the service areas have been extended so as to cover twice the population served in December, 1923, and the number of licences has increased three and a-half times in the same period.

Peru.—MONOPOLY ENDED.—The Peruvian Broadcasting Co. has liquidated, and its selling rights and property have reverted to the Government, according to *Commerce Reports*, which announces that broadcasting is to be administered by the Marconi Co. for the Government, and expenses will be paid by licence fees of £1 semiannually on each receiving set. The monopoly is now void, and anyone may import and sell radio apparatus.

Wave-length Changes. — REDISTRIBUTION COMMENCED.—Sunday, November 14th, has been chosen as the date of changing the wave-lengths of most European stations, according to the scheme of the Office Internationale de Radiophonie, Geneva. The wave-meter of the London station, which has been made in Belgium, consists merely of a coil with a variable condenser in parallel with it, and there are two methods of operating it. The engineer can watch a little electric lamp, which glows when the instrument is tuned to the exact wave-length on which 2LO is transmitting; or, if greater accuracy is desired, he can watch the needle of a galvanometer connected with a thermo-couple, which is heated when 2LO's wave-length is found. The instrument measures to an accuracy of 300 parts in a million.

Yugo-Slavia.—REGULATIONS.—The regulations governing the use of private radio stations were amended on July 1st, 1926. A comparison with those originally issued in 1923 shows much fuller elaboration, but the essential features remain almost unchanged, and the new rulings are not less restrictive than the old ones.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—January 4th, 1927. P.M.G.'s Department. Bells and buzzers. (B.X. 2984.)*

Melbourne. P.M.G.'s Department. January 18th, 1927. Switchboard cable. (BX3013.)*

January 25th, 1927. Telephone transmitters and parts. (BX3012.)*

SYDNEY.—January 26th, 1927. New South Wales Government Railways. Electric railway car equipments, consisting of motors, control equipment, air compressors, pantographs and accessories (Spec. 1065). Chief Mechanical Engineer, Wilson Street, Redfern.

Municipal Council. December 1st. Tungsten filament electric lamps. (B.X. 2995.)*

Bishop Auckland.—November 18th. Auckland, Shildon, and Willington Joint Hospital Board. Electric lighting installation at Helmington Row Isolation Hospital, including fittings, &c. Particulars from Mr. S. Adams, Union Offices, Bishop Auckland.

Brighton.—November 25th. Electricity Department. One 15,625-kW turbo-alternator, with condensing plant and auxiliaries. (November 5th.)

Bradford. — November 13th. Tramways Committee. Stores for 12 months, including electrical fittings for tramcars (Sch. No. 3), insulated bolts and controller contacts (Sch. No. 7). Schedules from Mr. R. H. Wilkinson, general manager, 7, Hall Ings, Bradford.

Cardiff.—November 22nd. Electricity Department. One water-tube boiler, mechanical stokers, and forced-draught plant; steel chimney and grit-collecting plant; induced-draught plant. (October 29th.)

China.—SHANGHAI.—January 15th, 1927.—The Department of Overseas Trade states that a Chinese company holding a concession for the supply of water and electricity is inviting tenders for plant, comprising turbo-generators, condensers, boilers, switchgear and transformers, pumping set, and hand-operating travelling crane. (B.X. 2998.)*

Consett.—Urban District Council. Electric lighting installation in the Market Square. (See this issue.)

Croydon.—November 26th. Tramways Department. 10 complete bodies for electric tramcars, 10 sets of maximum traction bogie trucks, 10 sets of magnetic track and wheel-brake equipments, and 10 sets of electrical equipments, &c. (November 5th.)

Dublin.—December 9th. Great Southern Railways Co. Six months' supply of electric cables, electric lamps, &c. Forms of tender (6d. each) from the Stores Superintendent, G.S. Railways, Inchicore, Dublin.

Egypt.—CAIRO.—Egyptian State Railways, Telegraphs and Telephones. Chief Inspecting Engineer in London. Queen Anne's Chambers, Broadway, Westminster, S.W.1. 1,500 3-way switchboard cords, 1,000 3-way plugs for switchboard. Telegraph and telephone material (£55,000-£60,000) and telephone exchange materials.—*Reuter's Trade Service* (Cairo).

December 5th. Ministry of the Interior. Electric motors and accessories. (B.X. 2996.)*

Ministry of Education. December 16th. Five a.c. motors and switchboard for Assiut model workshops. (B.X. 3016.)*

Evesham.—November 15th. Town Council. Electric lighting installations at the Public Hall and Town Hall. Mr. J. Abbott, borough surveyor.

Farnworth.—November 22nd. Electricity Department. L.p. cables, distribution pillars, underground disconnecting boxes, house service cables and accessories. (See this issue.)

Hastings.—November 30th. Corporation. Two sets of electrically-driven turbine or centrifugal deepwell pumps, with all electrical equipment, &c. (November 5th.)

India.—December 21st. India Store Department. 280 miles (approx.) 110,000-V overhead transmission line. (October 29th.)

Latvia.—November 20th. Post and Telegraph Administration. High-frequency telephone equipment. (B.X. 2993.)*

Leeds.—November 17th. Board of Guardians. Electric lighting installation at Block No. 4, St. James' Hospital, Becket Street. Specifications, &c., from Mr. J. H. Ford, clerk to Board of Guardians, Poor Law Offices, South Parade.

Leyton.—November 19th. Urban District Council. Installation of electric lighting and a central heating system at Knotts Green Special School. (October 29th.)

London.—PADDINGTON.—November 19th. Great Western Railway. Stores, including telegraph instruments, electrical apparatus, electrical wires and cables, &c. (October 22nd.)

HAMMERSMITH.—November 26th. Electricity Department. Two water-tube boilers (45,000 lb. per hour), mechanical stokers, feed pumps, fans, piping, conveyors, bunkers, &c. (See this issue.)

Manchester.—November 19th. Electricity Department. Industrial electric motors, starting switches for d.c. motors and star-delta motor starters. (November 5th.)

November 22nd. Electricity Committee. Steelwork, &c., for extension of existing station, in turbine house, boiler house, switch house, and subsidiary works. Specification from Mr. H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall.

Milnrow (near Rochdale).—November 13th. Electric lighting installation at the Milnrow Reform Club, Dale Street. Tenders to secretary.

New Zealand.—WELLINGTON.—December 7th. Public Works Department. Induction regulator. (B.X. 2935.)*

January 4th, 1927. Switchgear and transformers for the Waikaremoana electric power scheme. (B.X. 2872.)*

January 18th, 1927. Transmission line steel towers for Waikaremoana power scheme. (A.X. 3732.)*

February 1st, 1927. Storage battery and booster for Waikaremoana. (B.X. 2937.)*

February 15th, 1927. Transformers for Waikato. (B.X. 2985.)*

December 14th. Sub-station cables and cable boxes for Arapuni. (B.X. 3010.)*

December 15th. Government Railways. Switchgear, cable, motor-generator sets, junction boxes, &c., for the Hutt Valley locomotive workshops. (B.X. 2949.)*

Post and Telegraph Department. December 6th. Key switches. (B.X. 2962.)*

Post and Telegraph Department. January 19th, 1927. Electric bells and tumbler switches. (BX3011.)*

Prestatyn.—December 6th. Urban District Council. Underground cables, overhead lines, transformers, e.h.p. and l.p. switchgear, and sub-station equipment. (See this issue.)

South Africa.—KEETMANSTROOP.—December 15th. Municipal Council. Material required for an electric lighting scheme. (B.X. 3007.)*

JOHANNESBURG.—December 11th. Municipal Council. H.p. cable. (B.X. 3017.)*

Sutton Coldfield.—December 14th. Electricity Department. One 1,000-kW steam turbine, with condensing plant, auxiliaries, and piping. (See this issue.)

Walton-on-the-Naze.—November 17th. Electricity Department. 2,300 yd. l.p. cable, joint boxes, compound and feeder pillars. (November 5th.)

Worthing.—November 23rd. Corporation. Fire-alarm system. (November 5th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—MELBOURNE.—Electricity Supply Committee. Accepted:—

Armour-clad switchgear.—Australian General Electric Co., Ltd. (£3,160); A. Reyrolle & Co., Ltd. (£5,488).
H.p. cables (£2,244).—W. T. Henley's Telegraph Works Co., Ltd.
Two 500-kVA, 3-phase transformers (£838).—Weymouths, Ltd.

Town Hall and Baths Committee. Recommended:—

Electric lighting fittings for the Town Hall (£5,883).—British General Electric Co., Ltd.

SYDNEY.—Electricity Supply Committee. Recommended:—

R.i. cables (£5,621).—Scott & Co. (Aust.) Pty., Ltd.

—*Tenders.*

Burton-on-Trent.—Electricity Committee. Accepted:—

Extension of l.p. mains at Church Greasley (£2,007).—Johnson and Phillips, Ltd.

Castleford.—Urban District Council. Accepted:—

Installing electric lighting at the Town Hall.—Masterman & Co.

Costa Rica.—It is stated that the Government of Costa Rica has placed with the Berlin A.E.G. an order for the electrification of the State Pacific railway between San José and Punta Arenas.

Golcar.—Urban Council. Accepted:—

Installing electric light in the Council houses.—Murrant & Smith.

Hull.—Hospital Committee. Accepted:—

Electric lighting of carriage drive at mental hospital (£135).—City Electrical Co. (Hull).

Electricity Committee. Electric lighting of offices:

James V. Coonan Company	£592
Alexr. Shaw & Sons	485
W. G. Padgett & Sons	549
City Electrical Co.	464
Wm. Broady & Son	610
Miller & Garness	903
Humber Electrical Engineering Co.	569
C. F. Pardoe (Accepted)	**451**
Napier & Wheeldon	525
H. Hyde & Co.	559

India.—DELHI.—Accepted:—

Installation of a complete system of "Pul-syn-etic" clocks.—Gent and Co., Ltd.

Leeds.—Electricity Committee. Accepted:—

Cable.—(£5,212), W. T. Henley's Telegraph Works Co., Ltd.; (£19,700), Macintosh Cable Co., Ltd.; and (£1,550), Greenwich Cable Works, Ltd.

London.—LONDON COUNTY COUNCIL.—Education Committee.

Wiring and fitting County Secondary School, Wandsworth:

Alpha Manufacturing and Electrical Co., Ltd. (Recommended.)	**£1,161**
T. Clarke & Co., Ltd.	1,292
A. E. Humphreys	1,342
Thomas H. Buxton	1,358
Gaillard, Robinson & Co.	1,373
Smethurst & Co. (London), Ltd.	1,402
Alex. Hawkins & Sons	1,539
Richard Hunt & Co., Ltd.	1,541
G. E. Taylor & Co.	1,583
Morris Electrical Co., Ltd.	2,900

Manchester.—Public Health Committee. Accepted:—

Electric food mixer.—A. Cooper.
Electric coal lift at Victoria Square Dwellings.—H. Middleton.

Tramways Committee. Accepted:—

Special track work.—Hadfields, Ltd.; Edgar Allen & Co., Ltd.; Titan Track Work Co., Ltd.
Electric arc welding plant and rail filing machine.—Equipment and Engineering Co.

Electricity Committee. Accepted:—

Cable supplies.—Pirelli-General Cable Works, Ltd.; Standard Telephones and Cables, Ltd.; W. T. Glover & Co., Ltd.

Morecambe.—Electricity Committee. Accepted:—

E.h.p. cable.—W. T. Glover & Co., Ltd.

Newton Stewart.—

Electrical installation at Douglas Ewart High School (£885).—W. Auld and Sons.

Rochdale.—Board of Guardians. Accepted:—

Electrical plant, including electric cookers, electric water heaters, &c.—Fryer & Hartley.

Sheffield.—Electric Supply Committee. Accepted:—

10,000-12,500-kW turbine and alternator at Neepsend generating station (£28,423).—English Electric Co., Ltd.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

ISOLA cable connectors.

Forthcoming Events.

Birmingham Electric Club.—Friday, November 12th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper on "Electric Tramways," by Mr. A. C. Baker.

Junior Institution of Engineers.—Friday, November 12th. At 39, Victoria Street, S.W.1. At 7.30 p.m. Annual general meeting.
Friday, November 19th. Lecturette on "Short-Wave Wireless Communication," by Mr. B. J. Axten.

Physical Society of London.—Friday, November 12th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary scientific meeting.

Association of Mining Electrical Engineers (North of England Branch). Saturday, November 13th. At Neville Hall, Newcastle-on-Tyne. At 3 p.m. Paper on "Induction Motors: Their Principal Characteristics and some Special Applications," by Mr. A. B. MacLean.

Royal Society of Arts.—Monday, November 15th. At John Street, Adelphi, W.C. At 8 p.m. Howard Lecture on "Recent Experiments on the Properties of Steam at High Pressure," by Prof. H. L. Callendar, F.R.S.

Electrical Society of Glasgow.—Tuesday, November 16th. At 30, Gordon Street, Glasgow. At 7.30 p.m. Paper on "Common and Uncommon Troubles Experienced in the Maintenance of Storage Batteries, and their Rectification," by Mr. E. C. McKinnon.

Paisley Association of Electrical Engineers.—Tuesday, November 16th. At the Town Hall, Paisley. At 7.30 p.m. Lecture on "Electric Lighting for Motor-'buses." by Mr. N. A. May.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, November 16th. At Rankine Hall, 39, Elmbank Crescent, Glasgow. At 7.30 p.m. Paper on "Diesel Engines," by Mr. D. M. Shannon.

Royal Institution.—Tuesday, November 16th. At 21, Albemarle Street, W.1. At 5.15 p.m. Lecture on "The Acoustics of Public Buildings," by Dr. G. W. C. Kaye.

Society of Technical Engineers (London Branch).—Wednesday, November 17th. At 102, Belgrave Road, S.W.1. At 7.30 p.m. Address on "The New Laws Relating to Industrial Organisation in Italy," by Commendotore Lingi Villari.

(Manchester Area).—Wednesday, November 17th. At the Milton Hall, Deansgate, Manchester. At 8 p.m. Address on "Impressions of Industrial Conditions in U.S.A.," by Mr. S. Ratcliffe.

Edinburgh Electrical Society.—Thursday, November 18th. At the Royal Scottish Society of Art, 117, George Street. At 8 p.m. Paper on "Wireless Valves: Their Application and Characteristics," by Mr. F. E. Henderson.

Meter Engineers' Technical Association.—Thursday, November 18th. At the Lighting Service Bureau, 15, Savoy Street, W.C.2. At 7 p.m. Paper on "Points of View in Metering Theory," by Mr. E. W. Hill.

Institution of Electrical Engineers.—Thursday, November 18th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Lecture on "The Applications of Electricity to Agriculture," by Dr. A. Ekstrom, and exhibition of a film entitled "American Agriculture and Farm-house Electrification," by Mr. J. W. Beauchamp.

(Tees-Side Sub-Centre).—Monday, November 15th. At the Cleveland Technical Institute, Middlesbrough. At 7 p.m. Address by Mr. J. Rosen, Chairman of the North-Eastern Centre.

(North Midland Centre).—Tuesday, November 16th. At the Hotel Metropole, Leeds. Address by the Chairman, Mr. W. W. E. French, and smoking concert.

(London Students' Section).—Wednesday, November 17th. At Australia House, Strand, W.C.4. From 7.30 to 12 p.m. Carnival dance.

(Sheffield Sub-Centre).—Wednesday, November 17th. At the Royal Victoria Hotel, Sheffield. At 7.30 p.m. Paper on "Flameproof Mining Electrical Apparatus," by Mr. H. Rainford.

Institution of Mechanical Engineers.—Friday, November 19th. At the Institution, Storey's Gate, St. James Park, S.W. At 6 p.m. Paper on "Electric Locomotives: A Method of Classifying, Analysing, and Comparing their Characteristics," by Mr. T. A. F. Stone.

British Electrical Development Association.—Friday, November 19th. At the Royal Society of Arts, John Street, Adelphi, W.C.2. At 7.30 p.m. Paper on "Shop Window Display," by Mr. E. Willson.

Electrical Trades Commercial Travellers' Association.—Friday, November 19th. At St. Bride's Institute, E.C.4. At 7 p.m. Annual general meeting.

Electrical Power Engineers' Association (Kent Section).—Saturday, November 20th. At the Church Institute, Maidstone. At 3 p.m. General meeting. At 6.30 p.m. At the Old Palace, Maidstone. Annual dinner.

Electric Lamp Flicker.—Investigation by Herr K. Simons has tended to show that the eye is most sensitive to flicker occurring with a periodicity of about 6 cycles per second; he also showed that the percentage variation of light which can be detected by the eye decreases with large increase of intensity of illumination. These results have been confirmed by an investigation undertaken at the Faraday House Testing Laboratories, published by the British Electrical and Allied Industries Research Association (Report Z/T22) in the I.E.E. *Journal*. The conclusions to be drawn therefrom are that between the limits of frequency of 6 to 10 cycles per second, which is within the limits of speed of gas engines, the percentage fluctuation of voltage should not be more than 0.2 per cent., which is equivalent to a cyclic irregularity of 1/500. It has been contended in some quarters that the limit laid down in the present B.E.A.M.A. Standardisation Rules of 1/150 for such engines is unnecessarily exacting, but this Report furnishes no support for the contention. In the light of previous work, which showed a logarithmic relationship between the percentage variation of light which can be detected by the eye and the intensity of illumination, it is seen that the result obtained would not have been different in character with any reasonable reduction of the illumination of the observed surface, and, whilst the investigators have deliberately taken an unfavourable case for test, the conditions are nevertheless not abnormal.

Notes.

The Electricity (Supply) Bill.—On Tuesday last the Electricity (Supply) Bill, as amended by Standing Committee C, was considered by the House of Commons on Report. A new clause was moved, transferring certain powers of the Electricity Commissioners to the Central Electricity Board, but was opposed by the Government and withdrawn. A proposed new clause annulling the power of the Commissioners to order a second change of frequency in an area where a scheme involving a change of frequency had already come into force was withdrawn after an assurance had been given that the matter would be dealt with by inserting a subsection in Clause 9. A new clause was moved setting up an appeal tribunal, to consist of five members appointed by the Lord Chancellor, but was rejected. A new clause intended to prevent competition with authorised undertakings was rejected.

A new clause enabling all local authority undertakers to sell electrical fittings and to adopt hire-purchase schemes was left to a free vote by the Government, and was agreed to without a division.

An amendment to Clause 1 making the Central Electricity Board an elective body was rejected.

An amendment to Clause 2, requiring the Board to co-ordinate the supply of electricity instead of undertaking the supply itself, was negatived, and another intended to enable the Board to generate electricity was defeated by 187 votes to 111. An amendment preventing the Board from delegating any of its powers with respect to selected stations without the consent of the owners was adopted.

Other proposed amendments were discussed and withdrawn, and the consideration of the Bill was adjourned.

Smoke-Abatement League.—We have received a copy of the seventh report of the Smoke Abatement League of Great Britain, which deals with the activities of the League during the nine months ended June 30th last. It is suggested that more effective educational work would be possible if "Clean-Air Weeks" were organised quite independently of the "Health Weeks," and that their scope might be extended along more practical lines, developing the idea into clean-air campaigns. The first series of handbooks dealing with smoke abatement was to be published in the autumn by Messrs. Ernest Benn, Ltd. It has also been decided to issue a periodical entitled "Clean Air."

Bungay Gas and Electricity Works.—Electricity supply for public and private purposes was inaugurated last week at Bungay. The supply is given from the gas and electricity works owned by Dr. John A. Purves, who is connected with a large number of electric light undertakings and has always held that gas and electricity should be run and worked together. The supply is alternating current, 3-phase, 50-cycle, and the generating plant, which is installed in an engine house adjoining the present gas house, consists of two 40-h.p. National gas engines and one 17-h.p. Tangye engine, which is used for night and light loads. These engines are belted to alternators, and the whole is controlled by a standard switchboard.

The gas which supplies the engines is made from two Tully gas plants, which have been erected in addition to the ordinary gas retorts in the gas house, and produce a cheap and efficient gas for power purposes.

The mains, all of which are overhead, consist of bare copper on steel poles in the centre of the town, and upon wooden poles in the outskirts.

The gas undertaking, which was purchased by Dr. Purves about a year ago, has been materially improved and brought up to date, and the combined undertaking is under the management of Mr. E. E. Messenger, who has an intimate knowledge not only of gas works but also of electricity undertakings. The total number of houses in Bungay is between 800 and 900, and of these about 300 are supplied with gas, while the new electricity department starts its business this week with approximately 100 premises already wired and connected. It will thus be seen that there is still a large scope for the development both of gas and electricity in the town. The public lighting of Bungay is carried out by means of efficient and modern gas lamps, and a contract has been entered into for electric pumping in connection with the sewerage undertaking recently inaugurated by the Council. The gas and electricity works have recently acquired and opened a showroom and offices in the market-place in Bungay, where gas and electric apparatus and fittings of all kinds can be seen.

The contract for the mains and the installation of services and meters, and also the bulk of the house wiring, has been carried out by Messrs. Partridge & Company, Limited, the managing director of the company being Miss Margaret M. Partridge, B.Sc. The plant has been supplied and erected by Messrs. Christy Bros. & Co., Ltd. The new steel-framed engine house was supplied and erected by Messrs. Boulton and Paul, Ltd., of Norwich.

In Dr. Purves's opinion, it is a matter of regret that more installations of this kind, which combine under one management gas and electricity, have not been instituted, as the combination of the two undertakings makes for economy in operation, for reduction in working costs, and for the possibility of a cheapening both of gas and of electricity to the public. Unfortunately at present the scarcity of fuel renders it impossible to charge a low price for either commodity.

A Diesel Locomotive with Magnetic Clutch Drive.—Successful trial runs have been carried out in Germany with a Diesel locomotive, in which the usual form of electric transmission to the driving wheels has been superseded by magnetic clutches. This locomotive, on trial, hauled a train weighing over 1,300 tons up a gradient of 1 in 100 at an average speed of 11 miles per hour, and the thermal efficiency obtained was about 28 per cent., which is higher than that of the Diesel locomotive with electric transmission. The locomotive is of the geared type and is fitted with four magnetic clutches, one being the main connection between the Diesel engine and the gear box, and the other three for operating the various gears. The engine is a 1,200-b.h.p. Diesel, and the locomotive is fitted with ten driving wheels. So successful have the tests been that a similar locomotive is now under construction for the German State Railways, the one just described having been ordered for Russia.

Electrical Development in Northern Ireland.—In the report of the Ministry of Commerce and the Electricity Commissioners for Northern Ireland for the year ended March 31st last, reference is made to the outlook for electrical development. The Ministry states that the greatest proportion of electrical energy supplied in the north is sold by the Belfast and Londonderry Corporations, and that the development in Northern Ireland depends upon an adequate demand to justify the provision of h.p. transmission lines. During the year under review consent was given to the erection of new generating stations at Coleraine, Cookstown, Rathfriland, Aughnacloy, and Ahoghill, while Portaferry and Portstewart received authority to install new generating plant. The Ministry confirmed Special Orders made by the Commissioners to the Enniskillen Electric Light and Power Co., Ltd., for supplying the urban district of Enniskillen and parts of the adjoining rural district; the Portadown Electrical Co., Ltd., for the urban district of Portadown, and to the Coleraine Urban District Council for the urban district of Coleraine and parts of the adjoining rural district. Applications for Special Orders were also made by the Kilkeel Rural District Council to enable it to supply electricity to the town of Rostrevor; and the Armagh Urban District Council. Portadown Urban District Council was given powers to borrow £2,850 to purchase the local electricity undertaking, and provide further plant. The application of the Coleraine Urban District Council for borrowing powers in order to erect a generating station and provide mains and services was also being considered by the Commissioners. The growth of the Belfast undertaking involves additional capital expenditure; and the report records the granting of powers to the Corporation to borrow £177,812, of which amount £141,912 was for mains and services, £25,500 for meters, £5,000 for plant, and £5,500 for other purposes.

Lecture on Refrigeration.—A joint meeting of the members of the Institution of Engineers-in-Charge and the National Association of Supervising Electricians was held on October 27th, at Magnet House, Kingsway, the lecture hall having been placed at their disposal by the General Electric Co., Ltd. An address, which was followed by a discussion, was given by Mr. N. E. Barber on the subject of "Domestic and Small Commercial Refrigeration," with particular reference to the new "Magnet" type of refrigerating machine; this machine was subsequently demonstrated to the party.

Electrical Association for Women.—The Manchester Branch of the Association was started on October 26th with a meeting in the Lesser Free Trade Hall. A large number of people were present, and quite a good proportion of them joined the Association. Dr. S. Z. de Ferranti was the chief speaker; he pointed out how much saving of labour had been effected in factories within recent years and how necessary it was that the same proportion of labour should be saved in the work of the house. Mr. Mouat Jones, principal of the College of Technology, who was in the chair, mentioned the common complaint urged by people that they had not sufficient money to buy electrical appliances, but pointed out how few of these households had not found the money for "wireless," which was a pure luxury, whereas the other was a necessity. Miss Wilkinson, M.P., the President, was to have spoken, but her duties in the House of Commons prevented her being present. The chairman of the branch, Mrs. H. C. Lamb, wife of the Manchester city electrical engineer, made an excellent speech, proving the value to the housewife of the use of electricity for all kinds of work. Miss C. Haslett (London), Director of the Association, then explained its objects and the successful work which it had accomplished in public service although it had only been in existence for less than two years.

A New Electric Lamp.—What is described as a new electric lamp, shown for the first time in America at the recent Electrical Exposition at Grand Central Palace, is the invention of Prof. Gamain, of Paris. While designed particularly for studio lighting and motion picture photography, it is adaptable to any use where the best possible light is desired. Tested by the United States Bureau of Standards, the lamp is said to have given off exactly the same light as the daylight in Washington, D.C., on the afternoon of June 26th last. M. Paul Shambras, the artist, was one of the first to employ this new light. He has found that the Gamain lamp fully makes up for the lack of real sunlight during his working hours. The daylight appearance of the light from this lamp is produced by a system of mirrors and prisms, employing a natural mineral of cobalt to absorb the ultra-violet rays and diffuse the light in imitation of the diffusion of the sun's rays caused by the earth's atmosphere.

Bituminous Coal Conference.—We learn that at least four British scientists will attend the International Conference on Bituminous Coal, which is to be held at the Carnegie Institute of Technology, Pittsburgh, Penn., U.S.A., from November 15th to 18th next. The representatives from England, and their subjects, are:—Dr. C. H. Lander, director of fuel research of the Department of Industrial Research, "The Present Status of Low-Temperature Distillation of Coal in England"; Dr. R. Lessing, consulting engineer, London, "Coal and its Mineral Matter"; Mr. Geoffrey M. Gill, consulting engineer, London, "English Developments in Carbonisation of Coal in Gas Works"; and Mr. Harold Nielsen, Sensible Heat Distillation, Ltd., London, "The L. and N. Process."

Electro-Farming in Cheshire.—To demonstrate the possibilities of electro-farming, Chester Town Council has decided to enter into an agreement with the Institution of Agricultural Engineers and the Development Commission for an electricity scheme to be carried out, the Corporation offering a special tariff for three years of 1d. per kWh for electricity supplied to farms fully equipped with electrical apparatus up to the standards and requirements of the Development Commissioners.

This decision follows consideration by the Chester Electricity Committee of a report by Dr. B. J. Owen, Director of the Institution of Agricultural Engineers, Oxford. The report suggested making use of existing facilities, particularly at Chester, by which it was proposed to select six typical farms in the Corporation's area of supply, consisting of two arable, two mixed, and two dairy farms, a large and small representative of each type being taken, for the purpose of carrying out experiments and observation work. The farms will be equipped with modern electrically-driven appliances for the various operations at present carried out by hand or other power. It is estimated that it will take three years to carry out the trials. A workshop will also be erected for carrying out repairs to the machines and for reconstructional work. The cost of equipping the farms will be borne by the Development Commission.

Speaking at the Town Council meeting, on October 27th, Mr. C. Crosland Taylor (chairman of the Electricity Committee) said it was the Committee's wish to cut out "six farms" and to substitute "farms fully equipped with electrical appliances." The proposal was regarded as a very important one, as there was a great market for electrical energy on the leading farms in the Chester district. There were in the area 533 farms of 32,666 acres. The Electricity Committee proposed to place the workshops at the New Crane Street station at the disposal of the Development Commission.

What the Corporation wanted to do was to supply electrical apparatus for agricultural purposes on the hire-purchase system. The Committee, however, would not authorise anything to be supplied in this way, unless it was satisfied that the apparatus had passed beyond the experimental stage. One direction in which experiments would be made was electric ploughing.

Train Collision Report.—We have received a copy of the report on the official inquiry into the collision which occurred in August last, at Manors Junction, Newcastle, on the London and North-Eastern Railway, when an electric train came into side-long collision with a goods train which was crossing in front of it immediately west of Manors station. Considerable damage was done to the trains, and also to the third rail and the electric cables on the up and down Tynemouth lines. The motorman's body was discovered after the accident under the bridge near Heaton Station, showing that the train was uncontrolled when the collision occurred. This was explained later when it was found that the "dead man's" control handle had been deliberately tied up and rendered inoperative. It is concluded that nothing can excuse the motorman's action in tying up the control handle, and that he alone was responsible for the accident.

Local Societies.—A recent address by Mr. H. A. G. Howse, of Standard Telephones and Cables, Ltd., at the Birmingham Electric Club dealt with the thermionic valve, the lecturer pointing out that recent developments had been concerned with the filament; broadly speaking, three types of filament were now manufactured, namely, the hard-drawn tungsten filament, the thoriated-tungsten filament, and one of platinum-alloy coated with oxides of barium and strontium. In order to keep the current consumption of the plain tungsten filament low, it had to be drawn extremely fine and run at the high working temperature of about 2,000 deg. C., and it was, in consequence, very fragile. The thoriated-filament was mechanically as fragile as the tungsten filament, but required a lower operating temperature, which rendered it actually less fragile in practice; it had the disadvantage, however, of being easily overrun. The oxide-coated filament had the great advantage of running at a dull red heat, corresponding to a temperature of about 800 deg. C. All "B.S.A.-Standard" receiving valves and "Standard" transmitting valves up to the 250-watt valve, had oxide-coated filaments. The rate of volatilisation of the oxides, which was one of the limiting factors in the life of the valve, was almost negligible; owing to the high degree of emissivity of the coated surface, a relatively robust filament could be made, and there was the additional advantage that temporary overloads caused no damage. The minimum life of the smallest valve in which the oxide-coated filament was used was 2,000 hours, although one which had been on a life test had run 9,000 hours; the larger repeater valves had a minimum life of 20,000 hours. Owing to the emission characteristics of the coated filament, and the greater length of filament available for a given heating power, the geometry of the valve could be opened up, and a more rigid electrode structure employed. Conversely, a very small valve like the "peanut" could be made.

Glasgow.—Mr. R. B. Maccall, secretary and treasurer of the Corporation Electricity Department, on November 6th addressed the Domestic Science Teachers' Section of the Educational Institute. His subject was: "What the Corporation of Glasgow has done for the electricity consumer."

Domestic Electric Hot-Water Supply.—In a paper on the above subject read recently by Mr. C. G. Nobbs, M.I.E.E., before the National Association of Supervising Electricians, he dealt with the various designs of apparatus suitable for supplying the comparatively small and intermittent requirements of hot water for domestic purposes in the home. While such inordinate charges as 8d., 10d., and even 1s. per kWh were being made in this country, said the author, manufacturers of hot-water appliances were driven to the conclusion that the welfare and convenience of the community were matters of secondary importance. He referred also to the possibility of the generating station using its exhaust steam for district hot-water services, and said that by so doing, the thermal efficiency of the station could be raised to 60 or 70 per cent. In making a comparison between the different kinds of electrical apparatus on the market, Mr. Nobbs said that electricity could be applied most efficiently only by converting it into heat at the point required, as and when required, thereby eliminating both the line and standing heat losses. The only apparatus that could really fulfil these conditions was the geyser with an electrical loading sufficiently high to raise the temperature of the water, when flowing at an adequate rate, to the desired degree. He advocated the general use of the geyser, and held some electricity supply undertakings responsible for its non-adoption; they had discouraged the use of adequately-loaded geysers from mistaken fears as to the effect that a large number of highly-loaded appliances might have on their networks and plant. The present practice was to push apparatus of the storage type, with a small electrical loading, which was inflexible either as to the temperature or the quantity of water available, and in many cases was deficient in both. The gas geyser had educated the public to the benefits of an abundant supply of water at any time and at any desired temperature. At the sink a 6- or 8-kW geyser was the most suitable type. For the bath a 9- or 10-kW geyser would give a hot bath in about the same time as an average gas geyser—20 minutes. The author thought that the supply undertakings and the I.E.E. regulations should prohibit the use of the type of geyser in which bare heating coils were immersed in the water or in which the water was used as resistance.

Country House Lighting for Contractors.—In a recent note upon a country-house lighting booklet issued by the Chloride Electrical Storage Co., Ltd., we made mention of "Exide" batteries. We are informed that the name "Exide" is reserved for the company's portable types, and we should have referred to "Chloride" batteries.

Hospital Radio Installations.—A wireless installation has been provided at the Selly Oak Hospital, Birmingham, one of the largest hospitals in the Midlands. Four hundred pairs of 'phones are served by two B.T.-H. two-valve receivers, each having one stage of low-frequency amplification. In each receiver a "straight" detector and l.f. circuit is employed, and a choke-capacity filter circuit is added to the output terminals of each set; the primary of a B.T.-H. standard l.f. transformer is used as the choke, and two 2-mfd. condensers are inserted in the leads to the final output terminals, to which the lines are connected in parallel. This circuit deflects the heavy direct-current from the high-voltage battery and ensures that only the modulated high-frequency current shall pass into the lines, thus minimising the risk of possible short-circuiting of the lines. Five hundred yards of cable have been used, but reception is strong and pure in all the wards. It is intended eventually to equip the remaining 400 beds in the hospital in a similar manner. The installation was provided out of a fund contributed to by readers of the *Birmingham Gazette*.

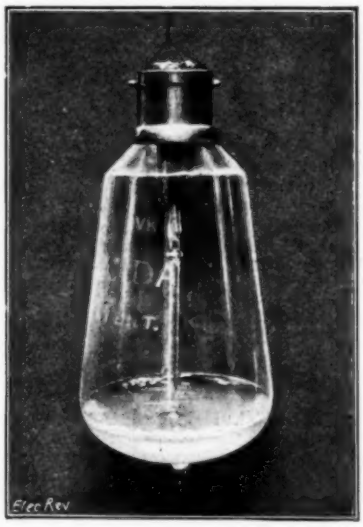
For the equipment at the Newtown Isolation Hospital, Worcester, the Birmingham branch of Metro-Vick Supplies, Ltd., was responsible. The outfit comprises a standard 5-valve "Cosmos" receiver, the amplifier of which has been made to give greater output, and a bank of 200-volt accumulators. The several blocks of the hospital are served by overhead cables, the receiver working constantly at maximum output. Volume-control devices are fitted in each ward, and the lines can be switched on and off in the matrons' quarters. At the side of the receiver panel five two-way switches are fitted, which serve the dual purpose of controlling the output and earthing the lines when they are not in use. Thirty pairs of 'phones and six loud-speakers can be worked simultaneously.

A wireless set, costing over £400, has been presented to the Providence Free Hospital, St. Helens, by the St. Helens Rotary Club. In addition to two loud speakers, there are 100 head-'phones, and when the surgical ward is completed thirty pairs of head-'phones will be placed in the building.

The Carnegie Trustees have offered to contribute £300 for the installation of wireless sets in 10 Kent schools.

The Physical Society's Exhibition.—It is announced that the seventeenth annual exhibition of the Physical Society and Optical Society of electrical, optical, and other physical apparatus will be held at the Imperial College of Science and Technology on January 4th, 5th, and 6th, 1927. The Councils of the above Societies have decided again to include in the annual exhibition a research and experimental section similar to that successfully initiated this year. Offers, giving preliminary particulars of the proposed exhibit, including space and other facilities required, should be addressed to the Secretary of the Physical Society, at the Imperial College of Science and Technology, South Kensington, S.W.7, not later than November 16th, 1926.

Sea Water in a Lamp.—Mr. W. C. Roy, engineer and manager of the Kirkwall and District electricity supply, has sent us a photograph (reproduced herewith) and says that it illustrates a lamp taken from the hall of a private dwelling house, situated on the sea front at Kirkwall. "The house having gone to 'earth' after a violent storm, during which the sea swept across the road, the lamp was found to be almost a quarter full of sea water. With the exception of the filament ment being broken, the lamp was in no way damaged, and was



Sea Water in Lamp.

still in the holder, hanging from the ceiling rose by two feet of flex. There was no apparent means by which the water could have got inside the bulb, the only feasible explanation being that the sea water had run down the flex, and running over the brass cap had, by capillary action, been drawn inside the bulb. I am sending this photograph as it may be of some interest to your readers, as, at least in my experience, it is unique to find sea water in a lamp inside a house. It illustrates the difficulties with which we have to contend in the far north."

A New G.V. Electric Truck.—A new 2-2½-ton electric truck, designed primarily to compete with the horse in congested city traffic has lately been put on the market by the General Vehicle Co., Ltd., of Birmingham, a feature being that all the units, such as the motor, battery cradles, steering gear, controller, and the front and rear axles, are mounted in such a manner that any of them can be removed for adjustment, repair, or cleaning, without interfering with any other parts. The service-wound 85-volt motor is slung on a bar on the centre-line of the chassis, between two cross members, being connected with the rear axle by a propeller shaft and worm gearing. The propeller shaft is tubular and is equipped with Hardy flexible disk joints at each end. Two types of battery can be fitted, an I.M.V.7, or an I.M.V.8, which weigh 1 ton 1 cwt. and 1 ton 3 cwt. respectively, making the weight of the chassis 3 tons 5¼ cwt. with the smaller battery, and 3 tons 7¼ cwt. with the larger. The battery boxes are ingeniously housed in a pair of cradles, suspended from the chassis frame by four hooks in such a manner that they can be removed complete in a very few minutes for battery exchange purposes. The batteries are contained in four roller trays, two on each side of the vehicle, each tray carrying 11 cells. They are normally enclosed by inspection doors, which on removal of two spring clips can be lowered into a horizontal position and the roller trays drawn outwards for battery inspection and topping up without necessitating the use of tools. The controller is of the G.V. standard type, providing a continuous torque and having five speeds forward and two reverse, operated by a lever on the right of the driver; the lever works in a gate, which has a stop to avoid any possibility of the driver accidentally putting it into the reverse position. A three-way switch is operated by a removable key, which can only be removed when in the "safe" position, so that the vehicle can be left standing in the street without fear of interference. The vehicle has a wheelbase of 10 ft. 6in., and a track of 5 ft. 3 in., whilst the road clearance when loaded is 10 in. It has a range of between 40 and 50 miles on one charge, whilst the speed when light is 13¼ m.p.h. and when fully loaded 12 m.p.h.

Changes in the Electricity Commission.—Under this heading, the *Electrical Power Engineer* (the official organ of the Electrical Power Engineers' Association) comments on Mr. S. L. Pearce's resignation of the post of Electricity Commissioner, as follows:—"One is strongly tempted to ask how it comes about that this misfortune has befallen us. It is hardly credible that Mr. Pearce decided to accept his new post because it was more lucrative than his present one. Those of us who know him at all intimately are quite satisfied that considerations of that nature would not influence him or cause him to swerve from the path of public duty. One must look deeper than that for the explanation of this surprising change. Several reasons will no doubt rush to the minds of our members, but the one that has been most frequently voiced is the one which past experience with Government Departments renders the most plausible. Did Mr. Pearce find the *rôle* of a Civil Servant, bound up with red tape and without scope to exercise initiative, so irksome and uncongenial that he longed to be freed from control by the politician and to return to the larger liberty and to enjoy that sense of being trusted, to which he had been accustomed whilst with the Manchester Corporation? It would not be discreet on our part to advance any support for such a theory. If, however, there is any soundness in it at all, and if it is true that reasons of this kind have caused him reluctantly to relinquish his post, then it is most regrettable, and no one, whilst they may bemoan the loss to the country, will begrudge him his translation to a more congenial sphere of labour. If the Government cannot retain the services of the best men because it does not know how to treat them properly, then so much the worse for the country and the supply industry, for it deserves to lose them. If the Electricity Commission, which is to play so important a part in the future development of the Electricity Supply Industry, is to have upon it the best brains, both technical and administrative, that the country can provide, then the conditions of office in that body must be such as will ensure that men of worth will willingly accept and retain a seat upon it. We do not suggest that the post of Commissioner must be made more attractive from the point of view of remuneration, or that the country must offer its servants higher salaries than are offered by the large power companies, any more than we would suggest that the country should pay its Judges higher salaries than could be made by them practising at the bar. But the position should at least be one of dignity, allowing scope for initiative and enterprise, and, above all, the holder of it should be made to feel that full confidence is being reposed in him, and that he is not being treated as an office boy, the underling of Whitehall bureaucrats, or the plaything of politicians.

"If Mr. Pearce, after having displayed such conspicuous ability by his work in connection with the Weir Report, and in that unprecedented period of stress during the general strike, lays down his task with a sigh of relief, we hope that the powers that be will see to it that the future holders of the office are treated better."

Large Mine Winder Motors.—The accompanying illustration has been reproduced from a photograph sent us by the Metropolitan-Vickers Electrical Co., Ltd. It shows the two field yokes of the winding motors for the City Deep Mine, Johannesburg, South Africa, and the company claims this winder equipment to be the biggest in the world. The two

Winding Motor Yokes, 20 ft. in diameter, for City Deep Mine, Johannesburg.

motors will drive a drum of bi-cylindro-conical construction, varying in diameter from 17 to 35 ft., and capable of dealing with a maximum peak load of 12,500 h.p. at a speed of 32.7 r.p.m.; 9¼ tons of ore are to be raised from a depth of 4,500 ft. at the rate of 31 winds per hour, the winding speed being 3,707 ft. per minute. Some idea of the size of the plant can be gained from the dimensions and weights of the principal units: the winding motors, for example, are nearly 20 ft. in diameter and weigh 150 tons each; the drum shaft weighs over 50 tons, whilst the drums themselves weigh approximately 350 tons and carry 18 tons of rope.

Sanca Pole Bases.—We are informed that the armoured concrete base for wood poles made in Spain, which was illustrated on page 714 of our issue of October 29th, is being made in that country under licence from the Société d'Applications Nouvelles du Ciment Armé, of 31, Rue de Richelieu, Paris. The bases are being used in large numbers in various parts of France. Being in two parts, they are easy to handle, and owing to the air space round the pole at the base, there is no danger of moisture collecting and causing rotting. There are no bolt holes through the pole at the base. In cases where it is desired to save an existing wood pole which has rotted at the ground line, it is supported by a tripod of prickers, and cut a few inches above the ground, the butt is taken away and replaced by the twin base pieces, bolted up, and the earth is filled in again. The whole operation is frequently carried out with the overhead line under high pressure.

Artificial Sunlight.—We are informed by the Engineering and Lighting Equipment Co., Ltd., St. Albans, that the artificial sunlight lamps installed at the Edinburgh Royal Infirmary (described in our issue of October 29th) are the company's "Sunrae" carbon-arc lamps.

The British Association.—It was announced last week that Sir Alfred Yarrow had contributed £10,000 to the funds of the British Association for the Advancement of Science. He has stipulated that the amount shall be expended within a period of twenty years.

Educational.—CITY AND GUILDS COLLEGE.—The Duke of York, on October 21st, opened the extension of the City and Guilds (Engineering) College, South Kensington, which has been provided by the Goldsmiths' Company at a cost of over £80,000.

Appointments Vacant.—Meter tester and repairer for Hastings Corporation Electricity Department. Boiler-house engineer (£457) for the Derby Corporation Electricity Department. Meter repairer for the Stepney Borough Council Electricity Department. Meter tester and sub-station switchboard attendant for the Ilkley Urban District Council Electricity Department. Cable jointer for the Middleton Borough Council Electricity Department. Deputy city electrical engineer (£750 to £1,000) for the City of Bradford Electricity Department. Junior assistant engineer (£204) for the County Borough of Newport Electricity Department. Leading shift engineer for the Borough of Dorchester Electricity Department. (See our advertisement pages to-day.)

Recent Developments in Television.—A paper was read before the Radio Society of Great Britain on Tuesday, October 26th, describing the Baird system of television, of which some particulars were given in our issue of November 5th (p. 748). The paper, which was read in the absence of the author by Colonel Yelf, was on the same lines as the one reported on p. 628 of our issue of October 15th.

In the discussion which followed, Mr. A. Hinderlich, referring to a suggestion that the results of Mr. Baird's researches would be placed at the disposal of the amateur, asked that some account should be given of the details on which research could be concentrated in order to solve the problem as speedily as possible.

A visitor, discussing the disk fitted with a number of lenses arranged in spiral fashion, said it seemed to him that that was equivalent to having a single fixed lens and a number of small holes arranged spirally on a much smaller disc. Referring to a disk which rotated at 4,000 r.p.m. for the purpose of chopping up the light, he suggested that when a large number of impulses were being sent a point would be reached at which it would be impossible to rotate the disk rapidly enough. If, for instance, 100,000 impulses per second were being sent, they would make a picture a few square inches in size, and the chopping-up effect would have to be at least 10 times as rapid, or 1,000,000 per second.

Mr. Maurice Child said he gathered that Mr. Baird had found it necessary to obtain a licence from the Postmaster-General in order to conduct his experiments on television. The Wireless Act of 1904, however, laid it down specifically that it should not apply in any way to the use of electrical machinery, or the use of waves for the control of electrical machinery other than for the transmission of messages, so that it was not necessary, in law, to obtain a licence in order to conduct experiments in wireless television, or the wireless transmission of pictures or images. One could control machinery at a distance by the use of Hertzian waves and could generate those waves in any way one liked, without the necessity for going to the Postmaster-General for permission. The Society should watch closely the working of the Act and should be careful not to allow things of this sort to slip in and create a precedent.

The Chairman (Brig.-Genl. Sir H. Capel Holden, K.C.B., F.R.S.), referred to the conversazione held at the Natural History Museum, South Kensington, at the time of the Jubilee of the electric telegraph, when the late Sir William Preece showed an apparatus which purported to transmit images. Apparatus was situated in two rooms at the Museum, and one was invited to send one's friend to one room and to speak to him from the other end of the line in the other room. The ordinary telephone transmitter and receiver were placed on a table, and beside it a black velvet curtain. Having called up one's friend at the other end of the line, and having received the reply signal in the ordinary way, the curtain being raised, one saw one's friend sitting at the telephone and heard him speak. This was the gigantic success of the evening; but unfortunately, those responsible for the entertainment had omitted to state that the whole thing was a fake, and that one was merely looking through a piece of thick plate glass, one's friend having been taken through the Museum and back again to the other side of the glass. The disastrous part of it was that some of the most prominent newspapers in the country had leading articles about it the next day, not having been warned that the whole thing was a conjuring trick, if one might call it so.

Legal.—DAMAGES FOR WRONGFUL ARREST.—In the King's Bench Division, on November 3rd, Mr. John F. Prendergast sued his former partner in an electrical engineering business, Mr. Graham H. Ellis, for damages for assault, malicious prosecution, and false imprisonment.

It was stated in evidence that the business went into voluntary liquidation and the defendant was appointed liquidator. In April, 1925, he stated that he had lost a "Megger." In January last the plaintiff borrowed an instrument of that type from the General Electric Co., Ltd., and at the instance of Mr. Ellis was arrested and charged with the theft of a "Megger." Later, the defendant abandoned the charge, stating that he would bring a civil action. The plaintiff complained that he was taken to the police station in full view of business friends, roughly handled, and imprisoned for about an hour.

No evidence was called for the defendant, and the Lord Chief Justice described his action as that of a man who had realised that he had been an "impetuous fool." There was not a tittle of evidence that larceny had taken place. The jury awarded the plaintiff £500 damages and costs, and his Lordship agreed.

Electricity Supply in Liverpool.—In our abstract of Mr. P. J. Robinson's address as chairman of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers, on p. 774 of our last issue, the use of very high combustion chambers in B. & W. boilers is said to "eliminate the nesting of birds on the tubes." The reference, as it appeared on the author's MS. and as we originally sent it to the printer, was "birds nesting"; the preferable form is "bird's-nesting," but the final shape that it took was wholly imaginative. Whilst we need not explain the meaning of the phrase to the interested reader, we must apologise to the author, who has been made to bear the unmerited stigma of a ridiculous blunder.

Institution Notes.

Institution of Electrical Engineers.—HON. MEMBER.—In opening the meeting of the Institution on November 4th, the president, Dr. W. H. Eccles, announced that the Council had that afternoon elected Senatore Guglielmo Marconi, G.C.V.O., D.Sc., LL.D., Hon. M.Inst.C.E., an honorary member of the I.E.E.

SOUTH-MIDLAND CENTRE.—*Wireless Section.*—It is proposed to hold meetings on Wednesday evenings, November 17th, December 8th, February 2nd, and March 16th at the Univercity, at 7 o'clock. The inaugural meeting to be held on November 17th will be addressed by Prof. C. L. Fortescue, O.B.E., M.A., chairman of the Wireless Section of the Institution. Inquiries may be addressed to Mr. A. T. Thurman, Electricity Supply Station, Soho Road, Handsworth, Birmingham.

STUDENTS' SECTION.—At the first ordinary meeting of the 1926-27 session, on November 2nd, Mr. A. P. Hill, B.Sc., read a paper entitled "The Tungar Rectifier," which was illustrated with lantern slides. The apparatus is well known as a thermionic valve rectifier of a.c. currents of moderate capacities, but it is understood that the author predicts greater possibilities for it, to the extent of even replacing mercury-arc rectifiers and rotary converters.

SCOTTISH CENTRE.—The annual report of the Committee for the 1925-26 session shows that the meetings numbered seven, at which the average attendance was 155, and the session ended with a total membership of 660, an increase of 8.

DUNDEE SUB-CENTRE.—Last session seven meetings were held, the average attendance being 33. The total membership was 57.

SCOTTISH STUDENTS' SECTION.—The meetings held last session numbered 15, including works visits, &c., and increased interest has been taken in discussions; the average attendance of 33 was a record.

Society of Engineers (Inc.).—On November 1st, a paper on "Some Products of a Small Machine Shop" was read by Miss A. Ashberry, managing director and works manager of Atalanta, Ltd. The author detailed the machines with which business was commenced by a small company in Loughborough six years ago, and explained how several contracts were carried out in spite of adverse conditions. One illustration showed a set of parts used in the construction of a microphone for broadcasting, and in the description of these an unusual feature was pointed out, this being a screw cut across the face of one of the components, a steel ring 4 in. in diameter, 64 threads per inch, with a 72-deg. tool, the depth of the grooves being .006 in. A large quantity of press stampings was being turned out for a company which had recently put a patent hairbrush on the market; mention was also made of some repetition work to fine limits for aircraft work recently completed, which had to pass A.I.D. inspection. During the past six months a new patent screwdriver had been manufactured in large quantities, this being a simple little tool, which can be operated with one hand.

Junior Institution of Engineers.—That designers should consult steel founders before sending out drawings of machine parts that were to be cast in steel was a point emphasised by

Mr. Robert Lowe, in a lecture on the subject of "Steel Castings in their Relation to Mechanical Engineering," at a meeting of the Institution on November 5th. The author said that trouble and expense could be saved by collaboration between the designer and founder on such points as method of construction, placing of cored holes, and position of machined surfaces. The principal art in steel foundry work lay in making the casting most sound at the most important places.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

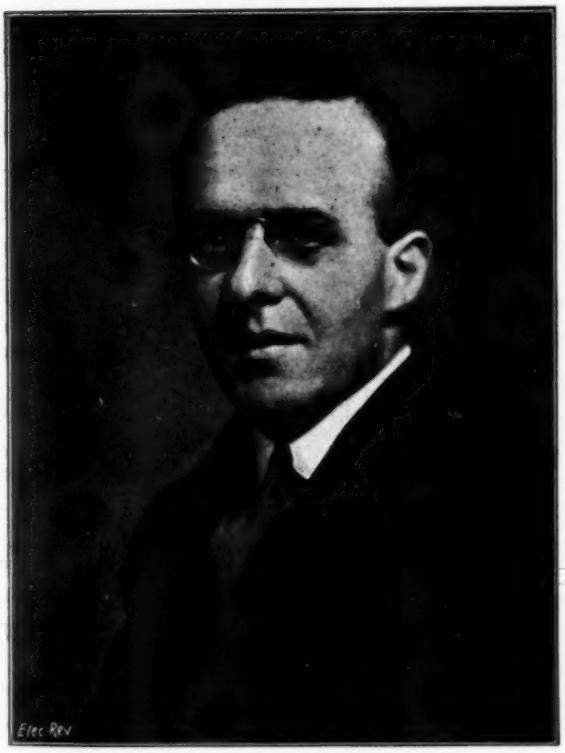
Mr. H. YOUNG has resigned his position with the Edison Swan Electric Co., Ltd., as departmental manager of the cable and wire and wireless departments, and has accepted a post with a well-known cable-making company.

Manchester Corporation Electricity Committee has appointed Mr. D. E. LAING, M.C., A.M.Inst.C.E., resident civil engineer in connection with the extensions to the Barton power station at £650 per annum.

Major J. L. BENTHALL has resigned his appointments as director of Vickers, Ltd., and special director in charge of the armour-plate department, Sheffield.

The following (all well-known city men) have been appointed directors of the Underground Electric Railway Companies of London:—Mr. S. B. JOEL, Mr. E. R. PEACOCK, the Hon. ARTHUR ASQUITH, and Mr. GORDON LEITH, C.B. Lord NEWTON has been appointed a director of the Central London Railway Co., and Sir ERNEST CLARK has become a director of the Metropolitan District Railway, the London Electric Railway, and several other companies. Messrs. BARING BROS. & Co., LTD., of which Mr. E. R. Peacock is managing director, have been appointed financial agents to the Underground Company.

Mr. J. ROSEN, whose portrait accompanies this note, is chairman of the North-Eastern Centre of the Institution of Electrical Engineers. He was born at Lydney, Gloucestershire, in 1892, and was educated at the City and Guilds Engineering College, afterwards becoming a pupil at the works of the Vauxhall and West Hydraulic Co., Ltd., and, later, at the works of Messrs. Dick, Kerr & Co., Ltd., Preston. His connection with his present company, Messrs. C. A. Parsons and Co., Ltd. was formed in 1912 when he entered their works as an improver. In 1914 he was appointed assistant electrical designer, and he became chief electrical engineer in 1918. In 1923 Mr. Rosen was awarded the John Hopkinson Premium by the Institution of Electrical Engineers for a paper entitled "Some Problems in High-speed Alternators and their Solution." Mr. Rosen delivered his inaugural address at Newcastle on October 25th, and it is to be repeated at the Cleveland Technical Institute, Middlesbrough, on November 15th.



Elliott & Fry] *[London.*

Mr. J. Rosen, M.I.E.E.,
Chairman of the North-Eastern Centre, I.E.E.

The chairman of the North-Western Centre of the Institution of Electrical Engineers this session is Mr. W. J. MEDLYN, whose portrait is reproduced below. Mr. Medlyn is a Cornishman, and has had a lengthy electrical experience. He entered the service of the Post Office at Falmouth in 1884, and in the following year became a telegraphist at Cardiff. Then, after a brief period with the Direct Spanish Telegraph Co., Ltd., he returned to the Post Office at Cardiff in 1888. He received his electrical training at the University College of South Wales and Monmouthshire, and in 1891 obtained an appointment in the P.O. Engineering Department under the late Sir John Gavey. From 1892 to 1896 Mr. Medlyn was engaged

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Mr. W. J. Medlyn, M.I.E.E.,
Chairman of the North-Western Centre, I.E.E.

at various submarine cable repeater stations, and later became sectional engineer at Leeds. In 1901 he went to the telephone branch of the G.P.O. and was engaged in re-designing the trunk switchboards and the signalling system. This new system was applied to the London Trunk Exchange, which was opened in 1904. Mr. Medlyn was subsequently assistant superintending engineer at Manchester, and since 1913 he has been superintending engineer of the South Lancashire District, which embraces Manchester, Salford, and Liverpool. Since 1913 Mr. Medlyn has been chairman of the South Lancashire Centre of the Institution of Post Office Electrical Engineers, and he is a member of the Council of the Manchester Geographical Society.

Hackney Borough Council Establishment and General Purposes Committee, on the advice of the Electricity Committee, recommends that, as from November 21st, the date on which Mr. E. K. WILKINSON takes over the duties of power station superintendent, Mr. H. A. KRASEMAN be promoted to the position of assistant power station superintendent at a salary of £462 per annum. The Committee also recommends that the Borough Council place on record its appreciation of the 25 years' service of Mr. Thomas Dalby, power station superintendent of the Council's electricity undertaking, and of the efficient and satisfactory manner in which he has carried out his duties, and that a copy of this resolution be engrossed on vellum, sealed with the Common Seal of the Council, and presented to Mr. Dalby upon his retirement.

Mr. A. J. OSTLER has been reluctantly compelled to resign the office of joint honorary secretary of the Western Centre of the I.E.E. It is proposed to make a presentation in recognition of his six years' term of office, and as a token of appreciation of his hard and willing work. The chairman and Committee have therefore opened a Presentation Fund, limiting the subscriptions to a maximum of 2s. 6d. payable to Mr. R. HODGE, hon. treasurer, Institution of Electrical Engineers, Western Centre, 43, Park Street, Bristol. It is hoped to make the presentation at the annual dinner on January 10th.

Mr. C. R. C. HART has been elected to the chairmanship of the Dermatine Co., and he will hold this position in addition to his office as managing director.

Obituary.—MR. W. JONES.—The death occurred suddenly on October 28th of Mr. William Jones, who was in business as an electrical engineer in High Street, Cobham, Surrey. He was 42 years of age.

New Companies Registered.

Inventum Electrical Appliances, Ltd. (217,245).—Private company. Registered November 2nd. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of electrical appliances, electricians, mechanical engineers and manufacturers, insulated wire and cable manufacturers, &c. The directors are:—Baron Robert Aernout de Lynden, 37, Pont Street, S.W.; Alan Wright, 2, St. James Road, Surbiton, electrical engineer. Qualification, 1 share. Solicitors: Nordon, Hugh-Jones & Flinn, 56, Moorgate, E.C.2. Registered office: 3, Chase Estate, Willesden Lane, N.W.10.

Priory Engineering Co. (Acton), Ltd. (217,257).—Private company. Registered November 3rd. Capital, £200 in £1 shares. Objects: To carry on the business of electrical, motor and wireless engineers, oxy-acetylene welding specialists, general engineers, dealers in all kinds of engineering and electrical accessories, &c. The first directors are:—W. C. Shepherd, 46, Rucklidge Avenue, Harlesden, N.W.10, builder; E. Hanshaw, 87, Southfield Road, Bedford Park, W.4, motor engineer. Qualification of above directors, 1 share; of subsequent directors, 100 shares. Registered office: 337, Acton Lane, Acton, W.3.

Ernest Graham, Ltd. (217,213).—Private company. Registered November 1st. Capital, £500 in £1 shares (250 7 per cent. cumulative preference and 250 ordinary). Objects: To carry on the business of manufacturers of lamp shades, stands, holders, brackets, and all accessories, cabinet makers, upholsterers, &c. The first directors are:—J. G. Graham, 18, Hart Street, Bloomsbury, W.C., lamp shade manufacturer; E. B. Haseldine, 56, Bingham Road, East Croydon, solicitor's managing clerk. Qualification, one share. Remuneration as fixed by the company.

H. P. Eyers & Co., Ltd. (217,256).—Private company. Registered November 3rd. Capital, £1,000 in £1 shares. Objects: To carry on at Parkstone, Bournemouth, or elsewhere the business of manufacturing, wholesale and retail electricians, manufacturers of wireless apparatus and materials, gramophones, records, printing, photography and stationery, &c. The provisional directors are:—H. P. Eyers, Oak Crest, Corfe Mullen, near Wimborne, Dorset; Emily M. Peskett, Oak Crest, Corfe Mullen, near Wimborne, Dorset. Qualification of directors, £50 ordinary shares. Manager, H. P. Eyers. Solicitor: F. W. Lewis, Institute Road, Swanage. Registered office: 325, Ashley Road, Parkstone, Dorset.

Freed-Eisemann Radio of Great Britain, Ltd. (217,180).—Private company. Registered October 30th. Capital, £2,500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless and other telegraphic and telephonic apparatus, instruments and equipment, &c. The subscribers (each with one share) are:—L. Toms, 2, Bond Court, Walbrook, E.C.4, clerk; E. J. Alldis, 2, Bond Court, Walbrook, E.C.4, clerk. The first directors are to be appointed by the subscribers. No qualification required. Solicitors: Linklaters & Paines, 2, Bond Court, Walbrook, E.C. Registered office: 91, Regent Street, W.1.

Newhaven and Seaford Electricity Co., Ltd. (217,228).—Public company. Registered November 1st. Capital, £5,000 in £1 shares. The objects are: To carry on in the U.K. or elsewhere the business of an electric light and power company in all its branches. The minimum cash subscription is 500 shares. The directors (to number not fewer than 2 nor more than 5) are:—J. G. B. Stone, Muir House, Broadwater, near Worthing, director of public company; K. A. Scott Moncrieff, M.I.E.E., The Clough, Oxted, engineer; E. H. F. Reeves, Field House, Friern Park, North Finchley, director of public company; J. N. A. Houblon, Boxford, Newbury, Berks., engineer; Lt.-Col. G. C. Stowell, Glendale, Church Road, Hanwell, secretary to public company. Qualification, £100. Remuneration as fixed by the company. Solicitors: Wilkinson, Bowen, Jackson & Curran, 34, Nicholas Lane, E.C.4. The registered office is at 424, Salisbury House, London Wall, E.C.2.

Sheffield Wireless Depôt (1926), Ltd. (217,108).—Private company. Registered October 27th. Capital, £500 in £1 shares. Objects: To acquire the business of a wireless apparatus dealer now carried on by T. F. McDonald at 178, Norfolk Street, Sheffield, as the "Sheffield Wireless Depôt." The subscribers (each with one share) are:—T. F. McDonald, 352, Sharrow Lane, Sheffield, wireless apparatus dealer; T. F. McDonald, junr., 352, Sharrow Lane, Sheffield, accountant's clerk. T. F. McDonald shall be permanent managing director so long as he holds £100 shares. Solicitors: M. J. Whitehead, Cadman Chambers, 131, Norfolk Street, Sheffield. Registered office: 178, Norfolk Street, Sheffield.

W. J. Hannah & Co., Ltd. (14,366).—Private company. Registered in Edinburgh November 4th. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturers, exporters and importers of, agents for and dealers in wireless components and accessories, radio receivers, electrical and mechanical appliances, engineers, electrical engineers and cabinet makers, &c. The first directors are:—W. J. Hannah, Cahimore, Brookfield, Renfrewshire, consulting engineer; J. W. Galloway, 38, Mair Street, Glasgow, manufacturer; J. G. Galloway, Kersland Croft, Hamilton Drive, Bothwell, engine packing manufacturer; K. W. Galloway, "Quarter," Largs, engine packing manufacturer. Qualification, £100 shares. Registered office: 95, Waterloo Street, Glasgow.

J. & L. Galloway, Ltd. (14,365).—Private company. Registered in Edinburgh November 4th. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturers, exporters and importers of, agents for and dealers in wireless instruments, wireless sets, radio receivers and electrical and mechanical appliances, engineers, cabinet makers, &c. The first directors are:—J. W. Galloway, 38, Mair Street, Glasgow, manufacturer; W. J. Hannah, Cahimore, Brookfield, Renfrewshire, consulting engineer; K. L. Galloway, 95, Fotheringay Road, Maxwell Park, Glasgow, engine packing manufacturer; J. W. Galloway, "Quarter," Largs, engine packing manufacturer. Qualification, £100 shares. Registered office: 38, Mair Street, Glasgow.

E. Mercer, Ltd. (217,177).—Private company. Registered October 30th. Capital, £2,000 in £1 shares. Objects: To acquire the business of an electrical and wireless engineer and contractor now carried on by Eli Mercer at Bridge Street, Castleford, 67, High Street, Normanton, and Corn Market, Pontefract, as "E. Mercer." The subscribers (each with one share) are:—E. Mercer, 37, Bridge Street, Castleford, electrical contractor; Mrs. C. Mercer, Righ Royd, Pontefract Road, Castleford. E. Mercer signs documents as director. Qualification, 50 shares. Remuneration (except managing director) as fixed by the company. Solicitors: Hartley & Worstenholme, County Chambers, Castleford. Registered office: 37, Bridge Street, Castleford, Yorks.

Official Returns of Electrical Companies.

Rayner & Heald, Ltd.—S. Horton, of Duke Street, Derby, ceased to act as receiver or manager on October 26th, 1926.

Thames Electric Co., Ltd. — Particulars filed of £5,000 debentures authorised October 9th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, if any, the whole amount being now issued.

Anderson & Penney, Ltd.—Two debentures dated September 25th, 1926, to secure £500 each, charged on the company's property, present and future, including uncalled capital. Holders: O. Anderson, 65, Stanhope Road, South Shields; and J. S. Penney, 88, Sunderland Road, South Shields.

Direct West India Cable Co., Ltd. (53,956). — Capital, £120,000 in £5 shares. Return dated October 7th, 1926. 12,000 shares taken up. £60,000 paid. Mortgages and charges, nil.

Instrument Screw Co., Ltd.—Debenture dated October 21st, 1926, to secure £2,000, constituting a specific charge on land at South Harrow and all the other freehold and leasehold property of the company, and a floating charge on the company's undertaking and other property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd., 15, Bishopsgate, E.C.2.

Coniston and District Electric Supply Co., Ltd. (138,478).—Capital, £2,000 in 1,500 6 per cent. preference and 500 ordinary shares of £1 each. Return dated October 9th, 1926. 1,440 preference and 500 ordinary shares taken up. £1,600 paid on 1,440 preference and 220 ordinary shares. £280 considered as paid on 280 ordinary shares. Mortgages and charges, nil.

John Collier & Co. (Electrical Engineers), Ltd. (174,260).—Capital, £20,000 in 12,000 "A" and 8,000 "B" shares of £1 each. Return dated October 22nd, 1926. All shares taken up. £2 paid. £19,998 considered as paid. Mortgages and charges, nil.

Edwd. Deane & Beal, Ltd. (92,885).—Capital, £60,000 in 20,000 preference and 40,000 ordinary shares of £1 each. Return dated December 30th, 1925 (filed June 24th, 1926). 20,000 preference and 20,009 ordinary shares taken up. £9 paid. £40,000 considered as paid. Mortgages and charges, £7,009.

Midland Radio Telephone Manufacturers, Ltd. — C. Furber, of Amblecote House, Brierley Hill, Staffs., was appointed receiver and manager by order of Court dated October 19th, 1926.

Auto Mechanical Rectifiers, Ltd.—R. S. Andrews, of 488, Strand, W.C.2, was appointed receiver and manager on October 28th, under powers contained in mortgage debenture dated July, 8th, 1926.

Scammell & Abbott, Ltd.—W. F. Chaundy, of 71, Temple Row, Birmingham, ceased to act as receiver or manager on October 4th, 1926.

Gil-Ray Trading Corporation, Ltd.—S. B. Saunders, of 26, Park Row, Nottingham, accountant, was appointed receiver and manager on November 3rd, under powers contained in debenture dated May 20th, 1926.

Natwirco, Ltd.—Debenture dated October 22nd, 1926, to secure £250, charged on the company's undertaking and property, including uncalled capital. Holders: National Wireless Corporation, Ltd., 52, Shaftesbury Avenue, W.1.

Hindhead and District Electric Light Co., Ltd.—Issue on October 28th, 1926, of £50 debentures, part of a series already registered.

Bastian Meter Co., Ltd.—Particulars filed on October 29th of £2,000 debentures authorised March 10th, 1926, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,050.

Hillingdon Screw and Manufacturing Co., Ltd.—Satisfaction in full on October 27th, 1926, of debenture dated July 31st, 1925, securing £600.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Lisbon Electric Tramways, Ltd.

The annual meeting of the company was held on November 3rd, Mr. L. Breitmeyer (chairman) presiding. In presenting the report (ELECTRICAL REVIEW, October 29th, p. 727), the chairman said that the company had made satisfactory progress during the year; the gross profit was larger and the rate of exchange had been steady. The tramway had been operated without interruption, and the system had been kept in a high state of efficiency. After reviewing the accounts, the chairman said that it had to be remembered that the ordinary shareholders had not received any dividend since 1915, and there were still two years' arrears of preference dividend. Thus they had to go a considerable way to recover lost ground. He was pleased to say that, judging by the results for the current year, there was every prospect of liquidating the arrears of preference dividend, and after that, if circumstances permitted, the question of a dividend on the ordinary shares would be considered. He hoped that a dividend would be paid some time next year.

The report and accounts were adopted.

West London and Provincial Electric and General Trust, Ltd.

A meeting of preference shareholders on November 3rd passed resolutions approving of an agreement between the company and themselves for the consolidation of the preference and ordinary shares into ordinary shares of one class. Mr. H. Kahn, who presided, explained that the step had been taken at the request of a large number of preference and ordinary shareholders, and when the capital had been altered, application would be made for an official Stock Exchange quotation. In passing, he mentioned that the Chiswick Electric Supply Corporation had shown even better results this year than last. The resolutions were then submitted to a meeting of holders of ordinary shares, and were subsequently approved by an extraordinary general meeting.

Electric Supply Co. of Victoria, Ltd.

The report for the year ended March 31st last shows a revenue of £159,707 and a gross profit of £57,904, as compared with £158,101 and £50,020 in 1924-25. The balance to the credit of profit and loss was £51,067, and to this was added £44,613 brought forward, making £95,680. After meeting debenture interest, &c., and preference dividend, it was proposed to pay a dividend of 10 per cent. on the ordinary shares, leaving £46,852 to be carried forward. The electricity connections showed an increase, but there was a slight fall in the tramway traffic, attributed to motor-'bus competition. The new turbine sets started up in January, 1925, are giving satisfactory results. The meeting was held last week at Liverpool.

German Companies.

The *Electricity Company* (late *Lahmeyer*), of Frankfort-on-Main, states that most of the undertakings in which the company is interested recorded an increase in connections and receipts in 1925-26. The directors complain of the high taxes to which these private undertakings are subject, while the municipal works are said to be exempt from the taxes. The dividend has been raised from 8 per cent. in 1924-25 to 9 per cent. for last year.

The *Rhenish-Westphalian Electricity Works Company*, Essen, reports that no change took place in the capacity of the stations in 1925-26, which remained at 475,000 kW. Although the gross income was greater than in the previous year the increase in working expenses and a larger provision made for depreciation have caused the net profits to be about the same as in 1924-25, namely, 12,040,000 marks, as against 12,030,000 marks, the rate of the dividend remaining at 8 per cent.

The *Poege Electricity Company*, Chemnitz, reports that it was possible in 1925-26 considerably to increase the capacity of the works, and that several goods and passenger locomotives will shortly be put into operation in Bavaria. After extinguishing the slight loss brought forward, the accounts show net profits of 217,000 marks, permitting of the payment of a dividend of 6 per cent. on the ordinary shares. An improvement in the receipt of orders has recently taken place, although the prices leave something to be desired.

French Companies.

The *Société Electro-Câble* reports net profits of 8,923,000 fr. for 1925-26, and a dividend of 50 fr. per share has been declared.

The *Société des Porcelaines et Appareillages Electriques Grammont* reports net profits and balance forward amounting to 179,000 fr. for 1925-26.

The *Société Electro-Métallurgie de Dives* has declared a dividended of 115 fr. per share out of net profits of 15,176,000 fr. in 1925-26.

The directors of the *Maison Breguet* recommend the payment of a dividend at the rate of 40 fr. per share for 1925-26, as against 50 fr. in the previous year.

The *Société des Accumulateurs Dinin* has declared a dividend of 22 per cent. for 1925-26, the net profits amounting to 3,544,000 fr., apart from the balance brought forward.

The *Société de Constructions Electriques de Nancy* reports net profits and balance forward amounting to 811,000 fr. for 1925-26, as compared with 326,000 fr. in the previous year, when no distribution was made. It is proposed to pay a dividend of 40 fr. per share for 1925-26.

The *Société Industrielle des Téléphones* reports an increase in the net profits from 9,236,000 fr. in 1924-25 to 10,850,000 fr. in 1925-26, the dividend being maintained at 50 fr. per share, although the share capital has been advanced from 24,000,000 fr. to 36,000,000 fr. in the meantime.

The *Compagnie Générale d'Electricité*, Paris, reports profits of 15,850,000 fr. for 1925-26, or 2,400,000 fr. more than in the previous year. It is proposed to pay a dividend of 70 fr. per share on the capital of 90,000,000 fr., as compared with the same rate on 75,000,000 fr. in 1924-25.

Belgian Companies.

A number of Belgian electricity supply undertakings have lately published their reports for the year ended June 30th last. The *Société Intercommunale Belge d'Electricité* reports a net profit of 17,501,332 fr., out of which a dividend of 5 per cent. is being declared. The *Société d'Electricité de l'Ouest de la Belgique* is also paying a dividend of 5 per cent. out of a net profit of 1,970,862 fr. The net profit of the *Société d'Electricité de l'Est de la Belgique* is given as 2,948,948 fr., out of which both preference and ordinary shareholders are receiving 5 per cent.; while the *Société d'Electricité de la Dendre* reports a net profit of 2,298,529 fr.

Société International d'Energie Hydro-Electrique ("*Sidro*").—Dividends at the following rates have been declared for the past year:—Preference shares 35.25 fr. (Belgas 7.05); ordinary shares 35.25 fr. (Belgas 7.05); and founders' shares 110.45 fr. (Belgas 22.09). It is stated that Belgian tax has been taken into consideration, and that the amount payable in Belgas will be converted into sterling at the sight rate ruling on the day of presentation of coupons. The Belga is a new currency unit for external transactions equivalent to 5 paper francs.

Spanish Company.—*The Union Electrica Madrilena* reports a profit of 4,500,000 pesetas for the past year, and has declared a dividend of 8 per cent.

Electrical Distribution of Yorkshire, Ltd.—Mr. R. W. Wickham presided at an extraordinary meeting on November 2nd, when a resolution was submitted providing for the doubling of the capital by the creation of 500,000 new shares of £1 each. The chairman explained that the new capital was required for the financing of the development of new districts and the extension of the supply in districts already served. When the latest Order was confirmed the company would be the authorised undertaker for 36 Orders in the West Riding with an area of supply of over 960 square miles and a population of 668,000. The resolution was passed.

Amalgamated Wireless Co. (Australia).—The Sydney correspondent of the *Financial Times* says that at the annual meeting, on October 29th, the directors reported a net profit for the year ended June 30th last of £12,190, compared with £5,030 for the previous year. The assets show £76,000 increase at £149,000, due to the coastal stations which have been transferred from the Government at cost for the establishment of overseas services. The company already operates services to ships, also to New Guinea and New Caledonia, and manufactures wireless apparatus, including that required for broadcasting stations. The directors are confident of the immediate success of the direct services by the "beam" system to England and Canada.

Joseph Lucas, Ltd.—Speaking at the annual meeting on November 2nd, Mr. Oliver Lucas (joint managing director), said that at the recent Motor Show at Olympia the company announced its unique magneto guarantee, covering all electrical and mechanical breakdowns, burning of contact-breaker points, and all wear and tear for a period of two years. As far as they knew, they were the first people in the world to produce a magneto able to carry such a guarantee. They had never been in such a state of restless activity as at present, and the fact of their association with C.A.V. and Rotax had served to show how much they had yet to do in all directions if they were to serve the trade as they wished.

City of London Electric Lighting Co., Ltd.—Last week this company advertised, for information only, particulars of the creation of £600,000 of 5 per cent. consolidated debenture stock ranking as a floating charge after the two existing debenture issues. It was explained that £380,000 of the stock was reserved for offer to the holders of the 4½ per cent. second debenture stock in exchange for their holdings, while the remaining £220,000 was required for necessary capital expenditure, and had been sold to an investment company.

Erinoid, Ltd.—At the annual meeting on November 3rd, the chairman (Mr. A. Binnie) said that towards the end of 1925 sales fell off, due to the dumping of German and French products, and the coal dispute had affected this year's sales. The company was, however, in an exceptionally strong financial position. The debenture debt had been reduced and useful additions had been made to the plant and machinery. The trade outlook was uncertain, but the company would secure its full share when trade revived.

Venezuela Telephone and Electrical Appliances Co., Ltd.—A short time ago the directors informed the shareholders that they had signed an agreement with Venezuelan interests for the sale of the company's undertaking for £425,000, and that the transaction was to take place on November 1st. It was announced last week, however, that the sale could not be completed by the stipulated date; indeed, it was not certain that it would take place.

Companies to be Struck off the Register.—The following companies are to be struck off the register in three months from November 9th unless cause is shown to the contrary:—

Bell Washer Co., Ltd.
Caergwrle and District Electricity Supply Co., Ltd.
Electro-Chemical Manure Co., Ltd.
Rotary Spark Arrester Co., Ltd.
Standard Electric Welding Co., Ltd.

Madras Electric Supply Corporation, Ltd.—The directors propose to increase the capital of the company to £800,000 by the creation of 146,000 new ordinary shares of £1 each. It is intended to offer 110,000 of these to present holders of ordinary shares.

New Issue.—*Hendon Electric Supply Co., Ltd.*—The company has decided to offer to its shareholders 50,000 new 6 per cent. cumulative preference shares of £1 each at 6d. premium. If they are not all taken up by November 15th they are to be placed on the Stock Exchange at 20s. 3d.

W. T. Henley's Telegraph Works Co., Ltd.—The directors have declared an interim dividend of 7½ per cent. (1s. 6d. per share) on the ordinary shares. Last year's interim dividend was 5 per cent.

Stock Exchange Notice.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Anglo-Portuguese Telephone.—£300,000 7 per cent. first mortgage convertible debenture stock, partly paid and fully paid.

Anglo-Portuguese Telephone Co., Ltd.—The directors have declared an interim dividend of 3 per cent. actual. This is the first distribution since 1920.

National Telewriter Co., Ltd.—The directors recommend a dividend of 1 per cent. on the preferred ordinary shares out of a balance of £6,609 for 1925-26.

Siemens Bros. & Co., Ltd.—An interim dividend at the rate of 2½ per cent. (6d. per share) has been declared, as in 1925.

Cape Electric Tramways, Ltd.—The directors recommend a final dividend of 4 per cent., making 7 per cent., free of tax, for the year.

Cawnpore Electric Supply Corporation, Ltd.—An interim dividend of 3 per cent. has been declared, as in 1925.

Stocks and Shares.

MONDAY EVENING.

No fresh announcements have been made up to this, Monday, evening since we last wrote, by any of the London electricity supply companies in regard to the capitalisation of their reserves and issue of bonus shares in respect thereof. The County Company's statement is expected immediately. It had been looked for last week, and two or three others are thought likely to appear almost simultaneously. Meanwhile, the tendency of the market is irregular. County ordinary strengthened to 3¼, while South Londons went back to 2¼, the latter having been a bad market, as mentioned previously,

for some time past. London Electrics shed a shilling to 35s. 6d., and this completes the tale of the week's movements amongst the Metropolitan issues.

Midland Counties are better at a guinea, due to the steady absorption of the company's recently issued new shares, the preference being up to 6d. premium and the ordinary strengthening to about the same price. Renewed circulation of rumours relating to the Bournemouth and Poole have resulted in a recovery to 60s. 6d. bid, though it is noticed that, whenever the price makes a move towards the neighbourhood of 3½, there are plenty of sellers at a little less. The high-priced shares in the list retain their strength. There is a fair amount of stock available, and, in view of the uncertainty of the next announcements, the market is naturally sensitive.

Johnson & Phillips have had a sharp fall, the price losing 4s. in a day and showing a drop of 5s. on the week at 58s. 9d. The price fell 10s. to 54s. at one time. The nervousness started by reason of the assistance which the company has extended to the Burndept Wireless Company, it being understood that the latter has received a substantial loan from Johnson & Phillips. This seemed to arouse apprehension in the minds of shareholders, and a rumour came into circulation that the dividend might be reduced. Taken in conjunction, the two factors were quite sufficient to upset the market, and the resultant weakness has sympathetically influenced other shares in the same group. It might have been supposed that an increase from 5 per cent. to 7½ per cent. in the interim dividend on Henleys would have saved the situation, but, in point of fact, it had little effect, and Henleys failed to recover their last week's loss which had left the price at £4. Callenders have gone back to 3¾, British Insulated to 3⅞. General Electrics are dull; Metropolitan-Vickers preference gave way to 2⅞. British Aluminium ordinary are 6d. down at 45s. 9d. Telephone Manufacturing have reacted a little to 8s. 6d.

Anglo-Portuguese Telephone shares rose to 17s. 6d., on the declaration of an interim dividend of 3 per cent. actual for the year ended with next month. This is the first time that the ordinary shares have received a dividend since 1920. The company recently issued £300,000 7 per cent. first convertible debenture stock, and in the prospectus it was said that the Board proposed to pay an interim dividend on the ordinary shares this month. Dealings have started in the new debenture stock, the price of which is ¼ premium, in spite of the fact that underwriters were left with something like 80 per cent. Bogota Telephones rallied to 32s. 6d. Venezuela Telephones are a nominal market, pending some further statement on the point of the hitch over the sale of the company's undertaking.

In the cable group, Eastern Extensions rose to 18, though Globes at 18¾ are 5s. down. The recent nervousness may be said to have subsided, and the market has returned to a normal condition, though prices are under those which ruled before the excitement over the "Beam" developments had led to such a sharp rise in the price of Marconis and to falls in cable securities. Marconis have come back to 16s., and Canadians are a little easier at 4s. 1¼d. Anglo-American Telegraph preferred is 1¼ down at 101.

Underground Electric Railways £1 shares rose to 11s. 10½d. on the appointment of four new directors, one of whom is Mr. S. B. Joel. This inferentially confirms the persistent market rumour, current for a long time past, that Mr. "Solly" Joel was taking a close personal interest in the company. The other Underground stocks are disposed to be dull. Metropolitan Consolidated can be bought at 60. The Stock Exchange impression is that the end of the coal dispute is near, and, discounting a settlement, prices of coal, iron and steel shares are better in most cases. Babcocks remain at 53s.

British Electric Traction ordinary, following up its gain of 1½ last week, is another 2 points higher at 143½, at which price there are buyers to be found. Further advances have taken place in British Columbia Electric Railway stocks, the deferred being 4 up, at 145. The Mexican Utilities are none too good, though Mexico Tramways Sixes rose to 47½. Mexican Light and Power preferred at 80 has shed 2½, and the second mortgage bonds drooped to 87. There has been a fair amount of animation in Brazilian Tractions; on balance, the price shows a moderate gain at 113. Anglo-Argentine Trams are dull. La Plata Trams, quoted at 2s. 3d., have gone up a little.

Of fixed-interest stocks available in the market, Tokyo Electric 6 per cent. sterling bonds can be bought at 90½, June and December interest, to pay 6¾ per cent. on the money, exclusive of redemption. Pernambuco Trams 5 per cent. first debentures, to bearer, are on offer at 74, giving a flat yield of £6 16s. per cent., with interest in January and July. Barcelona Traction 6½ per cent. prior lien, at 98½ (June and December) return £6 12s. per cent. on the money. There is also a small amount of British Columbia Railway 4½ per cent. perpetual consolidated debenture stock obtainable at 76½. This gives £5 11s. per cent. to an investor. The security is thoroughly well covered. Interest payments are due in March and September. An amount of £220,000 City of London Electric 5 per cent. consolidated debenture stock has been placed on the market during the past few days, at 99, free of stamp and fee. Interest accrues from date of payment; there will be a month's interest due in January next, after which the half-yearly dividend dates are July and January. The security is unimpeachable; as, indeed, it should be, to justify a quotation so near to that of the 5 per cent. War Loan.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1924.	Dividend. 1925.	Price Nov. 8 1926.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	14	14	60/6	+1/-	4 12 7
Brompton Ordinary	1	10	10	1⅝	—	5 12 9
Charing Cross Ordinary	1	15	15	2⅜	—	6 6 4
do. do. 4½ Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	48/3	—¼	6 4 4
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/-	—	5 14 4
County of London	1	15	15	3⅛	+1/16	4 16 1
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	21/3	—	6 8 9
Kensington Ordinary	5	15	15	17	—	4 8 3
Lancs. Light and Power	1	7½	7½	24/-	—	6 5 0
London Electric	1	10	10	35/6	—1/-	5 12 8
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	40/9	—	5 7 10
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	21/-	+6d.	5 14 3
Newcastle-on-Tyne Ordinary ...	1	7	7	21/3	—	6 11 9
do. 5% Pref. ...	1	5	5	17/6	—	5 14 3
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref. ...	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	18½	—	4 14 7
South London	1	15	15	2⅜	—1/16	5 14 3
South Metropolitan Pref.	1	7	7	1½	—	5 12 0
Urban Ordinary	1	4	7	1½	—	5 12 0
do. 6 % Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	2⅛	—	7 5 5
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

Home Rails.

Central London Ord. Assented ...	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	60	—½	8 6 8
do. District	,,	8½	8½	54	—	6 9 8
Underground Electric	£1	Nil	Nil	11/9	+3d.	Nil
do. do. Income ...	Bonds	6	6	101	—	*5 18 10

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	101	—1½	5 18 10
do. Def.	,,	1½	1½	24⅜	—	6 1 3
Automatic Telephone	1	3	10	2⅜	—	3 9 7
Chili Telephone	5	5	6	6⅜	—	4 7 4
Cuba Sub. Ord.	10	5	5	7⅜	—	7 0 4
Eastern Extension	10	10	10	18	+¼	*5 11 1
Eastern Tel. Ord.	Stock	10	10	180	—	*5 11 1
Globe Tel. and T. Ord.	10	10	10	18⅜	—¼	*5 6 8
do. do. Pref. ...	10	6	6	11⅛	—	5 7 10
Great Northern Tel.	10	22	20	27	—	7 8 2
Indo-European	25	8½	10	47½	—	*5 5 10
Marconi	1	10	Nil	1⅜	—	... ...
Marconi-Marine	1	10	7½	1⅛	—	6 13 4
Oriental Telephone Ord.	1	12	12	47/6	—	*5 1 3
United R. Plate Tel.	5	8	8	7⅜	—	*5 3 5
Western Telegraph	10	10	10	17⅜	—	*5 12 8

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3	—	9 3 4
do. do. 2nd Pref. ...	5	6	6	2½	—	10 13 4
do. do. 5% Deb. ...	Stock	5	5	74½	—½	6 14 3
British Electric Traction Ord. ...	,,	7	8	143½	+2	5 11 6
do. do. 6% Pref. ...	,,	6	6	110	—	5 9 1
Brazil Traction	100	4	5	113	+1	4 8 6
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	86½	—	5 15 7
do. do. Preferred ...	,,	90/-	126/9	115	+½	*5 13 1
do. do. Deferred ...	,,	129/5	8	145	+4	*5 10 4
do. do. Deb. ...	,,	4¼	4¼	77½	—	5 7 7
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	6/-	—	Nil
London United Tram. Deb. ...	Stock	4	4	40½	—	9 17 6
Mexico Trams, 5% Bonds	—	5	5	66½	—1	7 10 5
Mexican Light Common	100	Nil	Nil	35½	—	Nil
do. Pref.	100	Nil	Nil	80	—2½	Nil
do. 1st Bonds	—	5	5	66½	—	7 10 5
Yorkshire (West Riding)	1	5	—	11/6	—	... ...

Manufacturing Companies.

Babcock & Wilcox	1	12	13	53/-	—	4 18 1
British Aluminium Ord.	1	5	10	45/9	—6d.	4 7 5
British Elec. Transformer Pref. ...	1	Nil	7	18/3	—	7 18 5
British Insulated Ord.	1	15	15	3⅜	—1/16	4 8 11
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3¾	—1/16	4 12 4
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	12/-	—	... ...
Edison-Swan	4/-	10	10	12/9	—	3 2 7
do. 5% Deb.	Stock	5	5	86	—	5 16 3
Electric Construction	1	10	10	32/-	—	6 5 0
Enfield Cable Pref.	1	7½	7½	1⅛	—	6 6 4
English Electric	1	5	Nil	14/-	—	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	5	7½	29/-	—	5 3 5
Henley	1	16	20	4	—½	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1⅛	—	*4 14 1
Johnson & Phillips	1	10	17½	58/9	—5/-	5 19 2
Met.-Vickers Ord.	1	8	8	23/9	—	6 14 9
do. Pref.	2	8	8	2⅞	—1/16	6 18 4
Siemens Ord.	1	7½	7½	1⅛	—	5 4 4
Telegraph Construction	12	20	10	29½	—	*4 1 4

*Dividends paid free of Income Tax.

Russian Electrical Notes.

Rural Electrification Works.—The National Commission of Agriculture has prepared a scheme of rural electrification for the year which has just begun. It provides for a total expenditure of 13,500,000 roubles, which will permit of the establishment of works for the supply of 400 areas covering 63,000 villages. The works will be carried out by the rural co-operative societies and trusts. One third of the total sum to be spent is proposed to be provided by the rural population, while the balance is to be obtained by means of the system of rural credits.

Extension of Stations.—The Council of Labour and Defence has approved a scheme presented by the State Planning Commission for the extension of various stations in the new year. These contemplate the raising of the capacities of the Schatur, the Krasny Octyaber, the Balachnin, and the Moscow stations to 40,000 kW; the Kharkoff, the Shteroff, the Kieseloff, and the Kaschir stations to 20,000 kW; and the Lyapin station to 5,000 kW.

Electricity Supply in Moscow.—The plant capacity of the stations which supply Moscow and the region of Moscow is now far in excess of that in 1913, which was 56,000 kW. In 1916 the capacity was 96,000 kW, and at the present time it is 162,000 kW. The growth of the demand has exceeded the supply, and in the coming December is expected to amount to 180,000 kW, which it is impossible fully to satisfy. Under the circumstances it has been necessary to restrict new connections and adopt other measures so that the maximum load on the stations concerned will not exceed 140,000 kW. The extensions in progress and in contemplation for the Moscow province or region, which are expected to be completed in 1930-31, will involve an expenditure of 200,000,000 roubles, spread over a period of five years.

Manufacturing Costs.—A large reduction in the costs of production by the low-pressure works is reported to have taken place this year. Thus the prime costs of the manufacture of telephone apparatus are claimed to have been lowered by 14 per cent., meters by 9 per cent., installation materials by 21 per cent., and measuring apparatus by 27 per cent. The reduction in costs is explained not only by an increase in the efficiency of labour, which has compensated for the rise in wages, but also by the "rationalisation" of bulk production. On the other hand, the movement of the costs in the production of accumulators has been in the opposite direction. Thus the costs of portable accumulators have advanced from 5 to 6 per cent., and batteries for small radio installations have increased by 15 per cent. This has been due to the payment of higher wages and the high cost of raw materials.

Electrification in 1925-26.—According to a statement made by a representative of the General Electrical Commission concerning the work of electrification carried out in the financial year ended with September 30th last, only two regional stations were brought into operation. These were those of Nischni-Novgorod of a capacity of 20,000 kW, and the Shteroff station, 10,000 kW, while the Klasson station was increased to 16,000 kW and the Krasny Octyaber station to 10,000 kW. The big Volkhoff hydro-electric works was to be started provisionally on November 7th. Besides the regional stations mentioned, some works of local importance have also been opened this year. It is explained that considerable delay has taken place in the execution of works owing to the late period at which sanction was given for the placing of orders abroad for equipment and the allocation of the necessary funds, building operations having been considerably in advance of the availability of the machinery and plant.

Leningrad Electricity Supply.—The question of providing an adequate supply of energy for the industrial and other requirements of Leningrad continues to engage attention. The additional supply which is on the point of being obtained from the Volkhoff hydro-electric works will be far from sufficient to meet the growing demands, and the problem of erecting new hydro-electric works on the Neva and the Svir has been considered. According to the schemes already prepared, the Svir works will involve an expenditure of 61,000,000 roubles and be of a capacity of 68,000 kW, while the Neva works is said to necessitate an outlay of 71,000,000 roubles, for a plant capacity of 73,000 kW. A representative of the Supreme Council of National Economy recently stated that the supply question in Leningrad was such that no opposition would be raised with regard to the construction of the proposed Neva works. But as the State funds were limited and a further outlay of 9,000,000 roubles was still needed for the Volkhoff station, it was necessary for the local organisations to provide funds from the local budgets in order to begin the constructional works.

The Moscow Tramways.—At present there are stated to be 810 tramcars in service in Moscow, as compared with 816 in 1913, and the length of the lines is now 248 miles, as against 186 miles. The number of passengers carried has doubled since 1913. A further batch of 400 motor-cars and 100 trailers has been ordered, of which 80 have already been supplied.

White Russian Project.—A report from Minsk in the middle of October said that the State Planning Commission of White Russia had completed its preliminary work in connection with the construction of the first large power station in White Russia, the proposed site being at the Osinsk peat deposits. The expenditure on the works, which would also supply a part of the Smolensk regions, is estimated at 25,000,000 roubles.

Shortage of Materials.—The heavy electrical engineering trust is complaining of delays in the delivery of steel for the construction of tramway motors. As a consequence various towns have raised the question of obtaining such motors from abroad. The iron and steel trusts are also in arrears with the supply of materials for generators and steam turbines, which are therefore not being delivered to time. Similarly the supply of copper is insufficient, and is retarding the manufacture of cables.

The Dnieper Hydro-Electric Project.—The engineering representatives of the American firm of Cooper recently returned to Moscow after an examination on the spot of the great scheme for the utilisation of the water powers of the Dnieper. They are said to have approved the scheme in general, although suggesting various alterations. It is calculated that a period of four years and a half would be required to complete the works, which would be equipped initially with three sets of a total of 150,000 h.p., and would later be increased by the addition of seven further sets of similar capacity. As modified by the American experts, the execution of the project would involve an expenditure of $55,000,000, as compared with the original Russian estimate of $75,000,000. It is reported that the Siemens Constructional Union has entered the field as a competitor, and has dispatched engineers to visit the site of the projected works.

The Swiss Electrical Industry.

Effect of 52-hour Week.

THE Committee of the Swiss Commercial and Industrial Association has recently published its valuable and interesting annual survey of the economic and financial condition of the country. It refers to the year 1925.

Dealing with electrical manufacture, it says that dynamo makers did not wholly realise the hopes which had arisen during the preceding year. The contracts remaining unexecuted at the beginning of 1925 brought about an increase of output at the beginning of the year, but during the second six months it became difficult to obtain new orders. Apart from the general factors which hindered the return of normal conditions, certain unusual elements, such as the stagnation in Great Britain and the scarcity of capital in Germany, helped to intensify competition in the world's markets. The report says that the two countries mentioned were anxious to obtain orders at a sacrifice in prices in order to liquidate their stocks. Everywhere it could be seen that the output capacity of works was too high compared with the capacity of the markets and the diminished purchasing power of consumers. Prices in consequence continued to weaken. Thanks to the application of the 52-hour week in Switzerland, it was possible to manufacture at prices and delivery dates such as permitted more effective competition abroad and brought in an adequate flow of new business. The uncertainty of the situation at the same time gave rise to some irregularity in the general activity and various branches of manufacture were living from hand to mouth. The large orders placed by the Federal Railways Department in 1924 provided a good quantity of work in shops dealing with railway equipment, but it is to be feared that when these orders are completed there will a distinct slackening unless the electrical manufacturers obtain fresh general business.

Sales possibilities abroad for winding gear were limited by foreign exchange difficulties and prices weakened continuously.

German Competition.

The market for electrical material and apparatus was affected by the abolition in the autumn of the restrictions on imports. Prices fell, as German goods were placed on the Swiss market at figures which represented only half the Swiss manufacturing costs. At the same time it was noticeable that semi-manufactured articles not made in Switzerland and usually obtained from Germany became much dearer.

With regard to insulated wires and cables it is evident from the report that the Swiss Manufacturers' Association is labouring under a grievance. It observes that after the abolition of the restrictions on imports, comparatively large quantities of rubber insulated wires and cables were brought in by newly-established firms, which had installed in Switzerland certain braiding machines. These firms, it is added, confined themselves to covering imported wires and cables which were sold subsequently as Swiss products. The Association questions whether the rubber employed in the imported cables is up to standard and suggests that the matter should be gone into and a stricter control exercised over the quality of the rubber utilised.

Makers of electrical recording and measuring instruments complain that foreign competition brought prices so low that profits were negligible. Exports declined in a disquieting fashion owing to high import duties abroad and the depreciation of the exchanges, notably the French franc.

Market for Radio Apparatus.

It would appear from the report that the Swiss makers of radio apparatus are dissatisfied with their share of the home trade. In a number of districts in Switzerland great interest is being taken in radio, but as the market is open without restriction to foreign manufacturers, the distributors as well as the public have grown accustomed to foreign makes, against which the Swiss find it difficult to compete. They blame the policy of admitting foreign exhibitors at the wireless exhibition at Zurich and complain particularly about the influx of low-priced French apparatus.

Wages.

Below is given a comparison of the average rates of wages paid in the Swiss machinery industries in 1923 and 1924:—

	1923.		1924.	
	Hourly Francs	Daily Francs	Hourly Francs	Daily Francs
Foremen, &c. ...	0.161	16.69	—	16.47
Skilled and semi-skilled	0.138	11.98	0.139	12.10
Unskilled	0.111	9.10	0.111	9.63
Women over 18 ...	0.68	6.40	0.71	6.33
Workers under 18 ...	0.53	5.09	0.45	4.93

From further detailed statistics of wages and the cost of living, it appears that whilst the index numbers of the cost of living in 1923, 1924, and 1925 were respectively 164, 171, and 167, those expressing the increase in the daily wage of the skilled worker in the machinery trades were 177, 179, and 185.

Progress in Illuminating Engineering.

Mr. J. Y. Fletcher presided at the opening meeting of the Illuminating Engineering Society on October 26th; this meeting is customarily devoted to reports of progress and exhibits of novelties, and the holding of the meeting at the Lighting Service Bureau was helpful in view of the facilities available for demonstration.

Mr. Gaster's opening address referred to the rapid growth of interest in illuminating engineering in this country, as illustrated by recent conferences and by the energetic propaganda now being conducted on the lighting of the home and kindred matters. An exceptionally important step during recent months had been the inclusion of provisions requiring sufficient and suitable lighting in the new Factories Bill, now before Parliament. The latter part of his address was concerned largely with the international aspect of illuminating engineering, and with the doings of Illuminating Engineering Societies in Europe and the United States. An event of great interest had been the formation of an Illuminating Engineering Society in Holland, whose members recently visited the Exhibition of Hygiene at Dresden. Here Professor Teichmüller, of Karlsruhe, conducted visitors over the special illumination exhibit, arranged under his supervision. The methods of the Dutch Illuminating Engineering Society and the Society in Germany have much in common with those of the Illuminating Engineering Society in London, and everywhere the important functions to be exercised by such bodies, if conducted in an impartial and scientific spirit, are fully recognised.

Following Mr. Gaster's address the Report of the Committee on Progress in Electric Lamps and Lighting Appliances was read by Mr. J. Y. Fletcher. On this occasion the Report was an exceptionally comprehensive one, containing a very able review of progress in electric lighting. Naturally, importance was assigned to the introduction of the "Pearlite" (internally frosted) bulb, which promises to be very helpful in securing the avoidance of glare. Allusion was made to the campaign in favour of better home lighting, and to the improvement in shop-window lighting which had resulted from the propaganda of last year. The standard of illumination in shop windows two years ago was 8 or possibly 10 foot-candles; to-day 50 foot-candles was often attained and sometimes exceeded.

In street lighting the need for progress was freely recognised. A contrast was drawn between the order of illumination provided in streets and on railways, and in the vehicles traversing them. There had, however, been instances of improved lighting installations, a notable tendency being the substitution of high-candle-power units. Thus in Sheffield 1,000-watt lamps were to replace the present 500-watt lamps, and in Leeds both 500- and 1,000-watt lamps were being installed. Other instances of effective lighting were to be found at Brighton, Eastbourne, Worthing, and other seaside resorts. One of the latest developments had been the introduction of an attractive pear-shaped unit, equipped with diffusing glassware and suitable for 1,000- and 1,500-watt lamps.

In electric trains 40-watt lamps were replacing the 30-watt lamps, and similar increases in candle-power in tramcars and 'buses were to be noted; the change was probably largely due to the introduction of gasfilled lamps with diffusing bulbs. Yet another feature had been the growth of luminous railway signalling, electric lamps in various colours being automatically controlled. The speed of signalling had thus been increased. Similar methods were being applied to the control of road traffic.

Numerous examples of decorative lighting carried out during the past year were mentioned. The flood-lighting of Canada House was an instance, and the coloured flood-lighting of the Pavilion at Brighton was said to be particularly effective. Other subjects touched upon in the report included church lighting, school lighting, commercial lighting, daylight lamps, &c. In conclusion, the adoption by the Trinity Brethren of incandescent electric lamps as their standard for the illumination of lighthouses and lightships was mentioned as a noteworthy development. Several lighthouses and lightships were being thus equipped. The smallest lamps utilised for this purpose were of 3 and 4 kW, and experiments with lamps taking up to 10 kW were proceeding.

A variety of interesting apparatus was exhibited. Mr. S. G. Elliott showed pictures of installations carried out on the Underground Railways, including an example of floodlighting and a novel method of lighting applied in one of the subways at Charing Cross tube station; the arrangement of shallow prismatic units on the roof in the latter case is particularly neat. Mr. A. Cunnington, of the Southern Railway, described a method of running a series of lamps for booking-hall and platform lighting off the main supply on electrified lines.

Photometric apparatus was illustrated by a new type of daylight-factor meter shown by Mr. Buckley, of the National Physical Laboratory, and the new model of the Holophane Lumeter exhibited by Mr. H. Allpress. Mr. W. G. Raffé discussed the lighting of ballrooms, with special reference to the use of colour, and Mr. E. E. Sharp (Venner Time Switches, Ltd.), made some remarks on the subject of time-switches and their varied applications for indoor and outdoor lighting.

The demonstration of Pearlite lamps by Mr. L. E. Buckell (General Electric Co., Ltd.), included a very effective experiment illustrating the diffusing qualities of such bulbs. When mounted in a frame with a colour-changing light behind they appear like luminescent pearls, and, without being themselves lighted up, would serve as an excellent basis for illuminated signs. The new Sheringham reflector, which is an offshoot of the Sheringham Daylight Appliance, was exhibited by Mr. Wheatley. This is based on direct light, the lamp being equipped with the usual form of opaque reflector, but having an inner coating in various colours. The resultant mixture of light, whilst not intended for exact colour-matching, approaches fairly close to daylight in appearance, and the loss of light is very much less than in the fully corrected Sheringham Daylight Apparatus. It is therefore expected that it will have many applications.

A series of attractive forms of decorative units was shown by Mr. Long (Metro-Vick Supplies, Ltd.), and by Mr. Hughes (Siemens and English Electric Lamp Co., Ltd.). The evolution of enclosed units of this kind is one of many useful additions to lighting equipment, and the effect of some of these types is very charming. Finally, mention should be made of a new form of spot-projector exhibited by Mr. L. G. Applebee, of the Strand Electrical & Engineering Co., Ltd., the possibilities of which were illustrated by lantern slides depicting scenes from "Joan of Arc."

The meeting was considered a most interesting and enjoyable one. It was announced that the next would be devoted to the subject of "Domestic Lighting."

The Development of the Telephone Service.

Electrical Communication and the Spirit of Public Service.

By W. J. MEDLYN, M.I.E.E.

(*Abstract of Chairman's address delivered at Manchester before the* North-Western Centre *of the* Institution of Electrical Engineers.)

This year is the Jubilee of the invention of the telephone, and it is therefore appropriate to make some observations on the development of the important public service born of this invention.

At the end of March, 1926, there were 1,421,150 telephones in Great Britain and Northern Ireland, including 11,000 belonging to railways and other private installations with facilities for communication with the national system, and about 20,000 in the systems maintained by the municipality of Hull and the Channel Islands. In the Post Office system there were 1,390,153 telephones, representing an increase of 9.1 per cent. since March, 1925; since 1913, despite the slowing down of development due to the war, the number of telephones in Great Britain has been doubled, and with the present regular annual increase of 9 per cent., the number will be doubled again in 8¼ years. At the end of March, 1925 (the latest date for which the published accounts are available) when there were 1,273,800 telephones connected to the Post Office system, the capital value of the plant and buildings was approximately £66,000,000, and the gross revenue nearly £15,000,000. The value of the net additions to plant and buildings during the year amounted to about £10,000,000.

The annual report of the American Telephone & Telegraph Co. shows that at December 31st, 1925, the Bell system comprised approximately 12 million telephones, with a capital value of a little over £600,000,000, and a gross revenue of £157,000,000. Over 800,000 telephones were added to the system during the year, and the net additions to the plant cost about £53,000,000. Altogether in the United States there are about 10,000 separate telephone companies, many of them small rural communities working their telephones on a co-operative basis.

It is interesting to observe that the average cost per telephone of the British Post Office is approximately the same as that of the American Bell Co. and the average operating and maintenance costs are also approximately the same in both cases.

In January, 1924, there were about 24½ million telephones in the world; 62 per cent. in the United States, 4 per cent. in Canada, 9 per cent. in Germany, and 5 per cent. in Great Britain and Northern Ireland, leaving a balance of 20 per cent. for the rest of the world. The total number of telephones in use at the present time is probably in the neighbourhood of 27 millions. The range of speech transmission has been vastly extended by the development of repeaters, and the scheme for long-distance services between this country and those of Europe, which was outlined by Mr. F. Gill in his presidential address in 1922, is now in process of being realised.

It is, perhaps, difficult to realise the extent to which the world's commerce and industry are dependent on the progress of science. The relationship between capital expenditure and gross income is summarised in the following table:—

Service.	(a) Capital.	(b) Gross revenue.	Proportion (a) to (b).
	£	£	
British telephones	66,000,000	15,000,000	4.4 to 1
U.S.A. (Bell) telephones	600,000,000	157,000,000	3.8 to 1
British tramways, &c.	96,000,000	29,000,000	3.3 to 1
British electricity supply	162,000,000	36,000,000	4.5 to 1
U.S.A. electricity supply	1,500,000,000	300,000,000	5.0 to 1

The pecuniary advantages resulting from the cumulative services of scientists are not capable of exact estimation, but the saving has resulted in very substantial financial benefits to the public, without taking into account the value accruing to the public in various ways from the use of telephone communication for the direction or control of business enterprises.

The London-Manchester underground telephone cable, which was brought into use in April, 1922, contains 160 pairs of copper wires, each wire weighing 40 lb. per mile; 104 pairs are designed for telephone communication, and 56 pairs for telegraph; by means of "phantom" apparatus the 104 telephone pairs can be utilised to form 156 long-distance lines. The length of the cable is nearly 200 miles and the grade of speech transmission is approximately equal to what would have been possible with about 13 miles of cable conductors of this size before the invention of loading coils and the application of the thermionic valve to telephone repeaters. To provide by means of overhead lines the same grade of speech transmission with the same number of circuits, wires weighing 400 lb. per mile carried upon six lines of poles would be required; an additional line carrying 56 single-wire telegraph lines, each wire weighing 150 lb. per mile, would be necessary. These seven overhead routes would cost at least £1,500,000 more than the cable; and, as sufficient public roads would not be available to accommodate the lines, it might be necessary to purchase or rent a fenced-off strip of land, say 30 ft. wide, for a great part of the distance of 200 miles. The saving effected represents the financial result of the advance of science in the short period of six years. The London-Manchester cable was unique in being the first telephone cable in this country designed for working through telephone repeaters.

What has been said about the telephone service applies with equal force to the electrical industry generally. It is quite certain that the present amenities of civilisation would be unobtainable without the applied science of electricity. Electricity undertakings of every class, whether they consist of weak-current communication or heavy-current installations, constitute a national common service, and can only be a success in so far as they succeed in satisfying the needs of the community, both as regards quality and price. That is the problem which we, as engineers, have to face to-day. Poor service is never cheap at any price.

Electric Power Generation.

The Trend of Future Development—The Training of Engineers.

By J. ROSEN, M.I.E.E.

(*Abstract of Chairman's Address delivered at Newcastle-upon-Tyne before the* NORTH-EASTERN CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

ELECTRICAL engineering provides one of the most wonderful examples of scientific research leading to enormous industrial development. In our present advances we are confined to what might be termed minor technical details, when they are compared with the greater possibilities of scientific advancement.

In the field of electrical power generation considerable progress is being made in power-station design. With the increasing efficiency obtained by the use of higher steam pressures and temperatures, attention has been focused upon improvements in the boiler house. The practice of pulverising the coal affords greater ease of control and, perhaps, a small gain in fuel economy; when "teething troubles" have been overcome, we may look for its general application. It is probable that this system, with its economic advantages, will in time displace boilers using chain-grate stokers, which, in spite of the great care and ingenuity shown in their manufacture and choice of materials, are at times costly in upkeep and a source of anxiety to the station engineer.

Speculating upon the next advance, we ask: Could not the fuel, after pulverising, be forced by blowers through pipe lines from the colliery direct to the power station? The saving of the high railway and terminal charges would permit a considerable capital outlay on pipes and yet show economy in working cost, and would avoid the uneconomical burning of coal in the steam locomotives at present employed for transporting the fuel to the power station.

A solution of some of our difficulties is a good load factor; to some extent interlinking will assist, but the best solution is the more extensive use of electricity for domestic purposes, for railway electrification, and for agriculture.

The problem of switching the heavy currents which have now to be dealt with in the large power stations is a serious one. Operating conditions have led to the consideration of alternators designed to generate at higher potentials, to eliminate the intermediate step-up transformers; they would have a high internal reactance, so that the short-circuit currents under fault conditions would be no greater than before. Such alternators would be equally, or more, robust and reliable than the lower-voltage plant. There would be some reduction in cost, and by thus removing one link and strengthening others in the chain the possibility of failure would be lessened.

There has been a tendency to consider that the Americans, with their 200,000-kW generator, are making too rapid advances in size, that they have too many eggs in one basket; but when we reflect that the demand per head of population in the well-populated areas is ten times as great as ours, we must decide that the size of unit is not out of proportion to

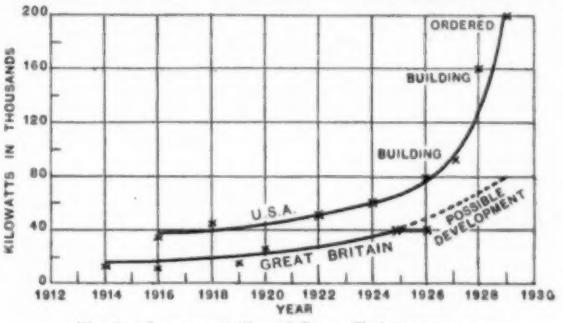


Fig. 1.—Increase of Size of Steam Turbo-generators.

their load. We have in this country cross-compounded turbo-alternators of 40,000 kW, and I have no doubt that when the various schemes now in view materialise, a 50,000-kW set using one alternator will not be considered too large. On the North-East Coast, with a maximum demand of not more than 150,000 kW, we have 25,000-kW sets; at Chicago, with a contemplated 2,000,000-kW maximum demand, the projected size of set is 200,000 kW; on the English basis they are entitled to a unit of 350,000 kW. I have prepared a diagram (fig. 1) illustrating the increase of size of sets in operation in America and here; English manufacturers have built the largest steam-operated plant for use abroad, but conditions have not warranted their use in England.

Among the developments with which we are concerned, in addition to those of purely scientific and technical interest, are the broader problems met with in the economic investigation of workshop methods to improve the quality and increase the output of our products. To achieve this end, facilities have to be provided for training the skilled artisan and technical worker in order that they may assist in the technical operations involved in the manufacture and operation of electrical plant. It has become essential to examine more carefully the systems by which a staff of skilled men can be made available; only by improving the knowledge of the artisan, draughtsman, and foreman can they shoulder responsibilities, leaving the important development work to be dealt with by more experienced engineers, who then act in an advisory capacity, their advice being sought only when difficulties arise. The importance of thus delegating duties, or authority, is recognised as essential to commercial and engineering success.

It is now realised that there is an ever-increasing necessity for the technical education not only of those responsible for the management, but also of the workmen. At the beginning, untrained men were of necessity drafted into the electrical workshops; they have undoubtedly done excellent work, but more is required of their successors, who receive a special training. I have no doubt that in future some of our skilled artisans will qualify for university degrees, or diplomas; many foremen have university degrees and have qualified as corporate members of this Institution. The young engineer must remember that his knowledge cannot be fully utilised, or appreciated, until it is blended with experience and judgment.

Electricity in a Public Water Supply.

The New Installation at Princes Risborough.

A FURTHER example of the usefulness of electricity in public service can be seen at the new water-supply undertaking of Princes Risborough and District, which claims to possess the most up-to-date water-supply system in the country. The installation is particularly interesting in that it enables the water to be pumped direct from the green sand, through a 10-in. bore, to the mains without passing through water towers or reservoirs, thus greatly reducing the cost of the installation and reducing the risk of pollution. The equipment, fig. 1, consists of two 3-throw plunger pumps, each capable of delivering 3,000 gallons of water per hour against a working head of 300 feet. One set of pumps is normally

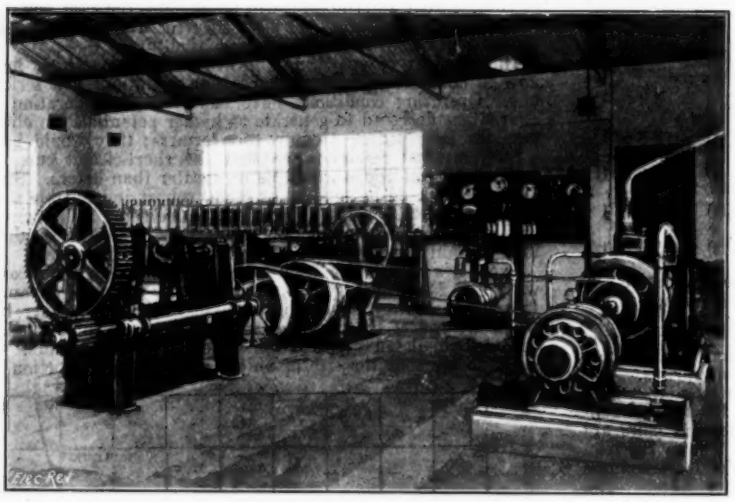


Fig. 1.—The Princes Risborough Pumping Plant.

driven by a " Lister-Bruston " automatic power plant, and the second by means of a 3-phase electric motor supplied with energy from the public mains. The gearing of the pumps is so arranged that, in emergency, each pump may be driven either by the " Lister-Bruston " plant or the electric motor. Before delivery to the town mains the water is passed through pneumatic pressure tanks, in which a pressure of 120-130 lb. per sq. in. is maintained. When the water is drawn off from the mains the pressure in the tanks begins to fall. As a result of this pressure reduction, automatic switchgear, fig. 2, starts up one of the pumps (pre-selected), which replaces the drawn-off water. In the event of a greater quantity of water being used than one set of pumps is capable of supplying the second

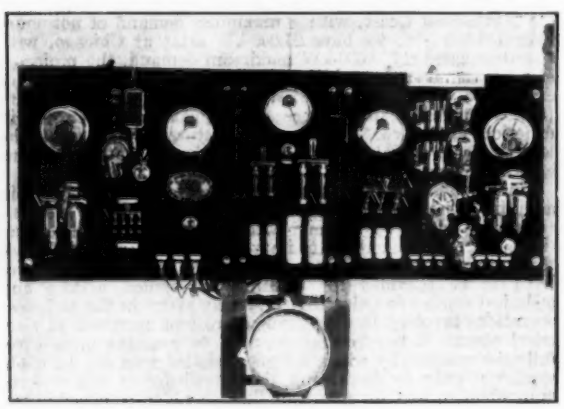


Fig. 2.—Automatic Starting Switchgear.

pump will automatically start and continue running until the demand for water is reduced. The automatic feature also applies in the event of either the petrol-driven pump or the electric drive failing, when the reserve plant is put into operation. The installation at the present time feeds approximately five miles of main.

The Fleming Portrait Fund.—We learn that Sir William Orpen has consented to paint Prof. Fleming's portrait. The committee is anxious to bring the fund to a successful conclusion; the hon. secretary is Mr. W. C. Clinton, University College, Gower Street, W.C.1.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

The " Venauto " Time Switch.

Most broadcast listeners have experienced the disappointment of missing an important item in the programme through forgetting to switch on their receiving sets at the proper time. Some people like to retire for the night occasionally before the conclusion of the programme and take their head-'phones with them, a not unusual procedure in the case of an invalid or temporary indisposition, but do not relish getting out of bed to switch the set off at the end of the entertainment. To meet such needs the " Venauto " clock switch is

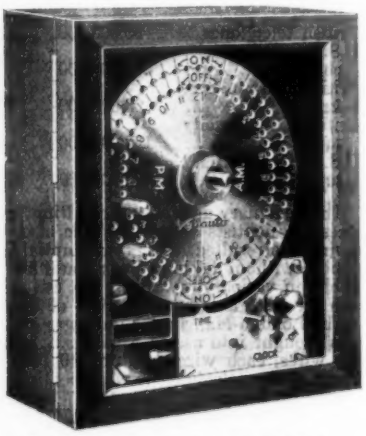
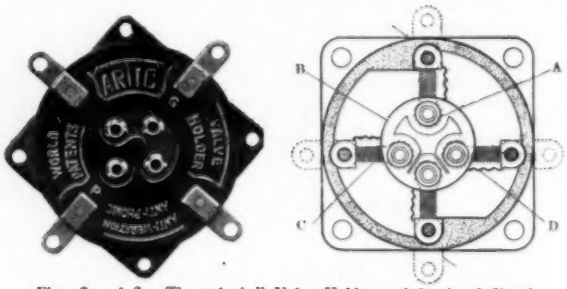


Fig. 1.—The " Venauto " Clock Switch.

well suited: the dial can be set for the reception of several selected items and the clockwork will switch on the receiver in due course at the appropriate times, excluding unwanted items. The single-pole switch will carry 5 amperes at ordinary low voltages, and can be operated by hand, if desired, without interfering with the clock settings; the clock is an 8-day one, with a lever escapement having solid steel pallets, and the whole apparatus is housed in a polished mahogany box with a glass front. As shown in fig. 1, the dial is tapped at half-hour intervals, and 12 screw pins are supplied, allowing for six switchings on and six off per day. The device is a product of VENNER TIME SWITCHES, LTD.

The " Artic " Valve Holder.

A new anti-vibration valve holder, which should be satisfactory provided it is mounted in an upright position, is being marketed by the Artic Fuse & Electrical Mfg. Co., Ltd.



Figs. 2 and 3.—The "Artic" Valve Holder and Sectional Sketch.

It is contended that the springs and sheet-metal strips usually employed as the supporting medium, not only have a sectional area much greater than that of the filament they are intended to protect, thus being liable to transmit vibration to the latter, but also have periodicities of their own that tend to set up additional disturbance. The " Artic " principle, however, has been utilised successfully by the British Admiralty to protect electric lamps from vibration and shock: the suspension medium consists of a plurality of phosphor-bronze gauze strips arranged with the warp and weft strands cut on the bias in such a manner that no single strand is connected directly between the outer casing and the suspended valve-holder sockets. The container (fig. 2) is made of moulded Bakelite, and fig. 3 shows that the valve-leg sockets A are carried on a Bakelite disk B floating in the centre; it is suspended by the four bronze gauze strips C, and the sockets are connected to the outer metal terminals by means of copper braid D. The holder is neatly made, though slightly larger than the familiar types.

A Metal Oxide Rectifier.

Prof. H. H. Sheldon, Ph.D., chairman of the Department of Physics, Washington Square College, New York University, gives some details in a recent issue of the *Scientific American* of a new rectifier which has distinct possibilities. A convenient way of using the device as a full-wave rectifier of a.c. is indicated in fig. 4, four rectifiers ABCD being so connected that the normal current flows through them in the direction indicated by the arrows, always in the same direction. The new rectifier, as described by Mr. L. O. Grondahl at a recent meeting of the American Physical Society, consists of a copper disk on which a layer of oxide is formed by heating the copper to a high temperature. One side of the disk is cleaned, so that the oxide coating is left on one side only; against the coated side a similar sized disk of lead is placed and the two disks are bolted tightly together, the nut and bolt being insulated with fibre or paper. The whole unit is no longer than a watch, being about 1.5 inches in diameter, yet it will rectify a large current on a very little voltage; about three amperes on a volt and a half. The resistance of a rectifier of the diameter mentioned will depend upon the pressure applied by screwing down the bolt, and may be as small as a fraction of an ohm. For a lower resistance, and consequently a larger current, oxidised copper disks of a larger area are used. This large current at low voltage is the particularly striking feature of

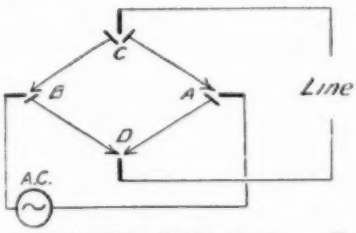


Fig. 4.—Bridge Rectifier Circuit.

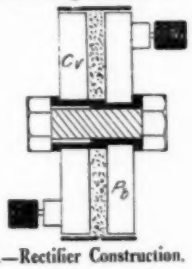


Fig. 5.—Rectifier Construction.

this rectifier. Crystal detectors are useful only for negligible current at high voltage; rectifiers used as h.t. battery eliminators use two to four hundred volts and pass a current of about 40 to 80 milliamperes, roughly. Hot-filament rectifiers, such as Rectigon or Tungar tubes, while passing a large current of a few amperes, nevertheless have the disadvantage of requiring current to heat the electron-emitting filament, which reduces their efficiency. The new device does away with such loss, and is simple and extremely cheap to construct.

Such a device also has many new uses which the necessity of a heated filament in the other types of high-current rectifiers prevents. One of these is to convert a direct-current instrument into one for measuring alternating current values by connecting one of the new rectifiers in series with the instrument, for its low resistance is small compared with any circuit in which it might be inserted. Other uses will occur to experimenters. In the case of a similar rectifier seen elsewhere, however, the lead was replaced by a different metal and the oxide by another oxide; the latter was used in powdered form between the metals as shown in fig. 5, the black portions representing insulation material and the dotted part the oxide. Since it is a rectifier that is desired, it would seem reasonable to use between the disks some crystal substance which has properties of rectification itself, or some other unusual electrical properties. There are many such, the effects in each case having a certain similarity, and suggest a possibility of success which the experimenter should not neglect.

A Link Insulator.

A novel pattern of radio aerial insulator that has been designed with a view to the improvement of insulation under all weather conditions is marketed by MOULDENSITE, LTD. The new device is made of an insulating material which is said to possess ample mechanical strength and to be non-absorbent. It takes the form of a short chain of three elongated links with what is described as knife-edge contact for the reduction of surface leakage.

A B.T.-H. Power Valve.

An exceptional amplifier is the "B11" valve produced by the British Thomson-Houston Co., Ltd.; essentially a power valve for the final l.f. stage, its large output renders it unsuitable for connecting directly to the loud-speaker; to prevent overloading the latter it is recommended that a capacity of from 2 to 4 mfd. be connected in series, and a minimum inductance of 5 henries in parallel, with it. Its filament current is 0.5 A at 6 V; with an anode voltage of 180 V and grid bias of—30 V, the amplification factor is 3.5, the anode a.c. resistance 2,500 ohms, and the mutual a.c. conductance 1,400. The anode voltage may be raised to 200 V with safety if the grid bias is increased to — 33 V, when the anode current will reach 21 mA approximately.

More "Ediswan" Valves.

To its ¼-watt class the Edison Swan Electric Co., Ltd., has added two new valves of the dull-emitter type, of which we have had samples. The "GP2" is a general-purpose valve designed for both h.f. amplification and use in the initial l.f. stages. Its filament consumes 0.1 A at 2 V, with an anode voltage up to 120 V; its amplification factor is 10 and impedance 16,500 ohms. The "PV2" power valve is intended to serve as a companion to the "GP2" and "DR2" types in the last stages of l.f. amplification. Taking 0.15 A filament current at 2 V, with 120 V anode voltage, the amplification factor is 6 and impedance 9,000 ohms.

Birmingham Exhibitors, 1927.

THE following is a list of electrical firms who had taken space down to November 1st in the Electrical Trade Section of the British Industries Fair at Castle Bromwich, Birmingham (February 21st to March 4th):—

Barrett Wakefield & Co., Ltd., Birmingham.
Batteries, Ltd., Redditch.
Berry's Electric, Ltd., Birmingham.
Birkbys, Ltd., Liversidge.
British Electrical Repairs, Ltd., Birmingham.
Bulpitt & Sons, Ltd., Birmingham.
Calvete, I., Ltd., London, W.C.2.
Castle Fuse and Eng. Co., Ltd., Liverpool.
Chloride Electrical Storage Co., Ltd., Clifton Junction.
Coventry Electrical Accessories, Ltd., Coventry.
Credenda Conduits Co., Ltd., Oldbury.
Daulby, S. J., Birmingham.
Electric Fires, Ltd., Norwich.
Ebonestos Insulators, Ltd., Birmingham.
Electrical Power Eng. Co. (Birmingham), Ltd., Birmingham.
Electricars, Ltd., Birmingham.
Ellison, G., Birmingham.
Excelsior Shade Mfg. Co., Ltd., West Bridgford.
General Electric Co., Ltd., Kingsway, W.C.2.
Gent & Co., Ltd., Leicester.
Hackbridge Elec. Construction Co., Ltd., Walton-on-Thames.
Harper, J., & Co., Ltd., Willenhall.
Hart Accumulator Co., Ltd., Stratford, E.
Hewittic Electric Co., Ltd., Walton-on-Thames.
Hunt, J. A. H., Birmingham.
Kelvin, Bottomley & Baird, Glasgow.
K. F. M. Engineering Co., Ltd., London, W.C.2.
London Electric Wire Co. & Smiths, Ltd., London, E.C.1.
Manda Motors, Ltd., London, E.C.
Macintosh Cable Co., Ltd., Derby.
McGeoch, W., & Co., Ltd., Birmingham.
Metropolitan-Vickers Electrical Co., Ltd., Trafford Park.
Millington, E. H., & Co., Ltd., Birmingham.
M.L. Magneto Syndicate, Ltd., Coventry.
Nobbs, G., Ltd., London, W.1.
Park Royal Engineering Co., Ltd., London, N.W.10.
Parsons, C. H., Ltd., Birmingham.
Premier Electric Heaters, Ltd., Birmingham.
Pritchett & Gold & E.P.S. Co., Ltd., London, S.W.1.
Record Electrical Co., Ltd., Altrincham.
Rudd, E., & Co., Birmingham.
Shropshire, Worcestershire, & Staffordshire Electrical Power Co., Birmingham.
Small, W. R., Birmingham.
Spauldings, Ltd., London, E.C.1.
Sturge & Baker, Ltd., Birmingham.
Tucker, J. H., & Co., Ltd., Tyseley, Birmingham.
T.V.E., Ltd., Hounslow.
Ward & Goldstone, Ltd., Pendleton.
Wingrove & Rogers, Ltd., Liverpool.

The Electrical Committee has been sitting this week to develop space-letting and other organisation arrangements. Firms should forward particulars of their space requirements, or requests for application forms, to the manager, British Industries Fair, 95, New Street, Birmingham.

Electricity Supply in Paris.—According to the *Electrical World*, in order to meet the increasing demand for electricity in Paris, the Compagnie Parisienne de Distribution de l'Electricité, in conjunction with the municipal authorities, has adopted no fewer than eight programmes, A to H. A and B, which are now completed, comprised an increase in the capacity of the plants at the Saint-Ouen and Issy-les Moulineaux stations from 120,000 kW to 330,000 kW. C, at present in hand, consists of replacing the old 10,000-kW generating sets with new ones of 12,000 kW, the frequency being at the same time changed from 41⅔ to 50 to enable the distribution system to be linked up with a supply of power from hydro-electric stations. This work is not expected to be completed until the beginning of the year 1928. D, also in hand, consists of installing at the Saint-Ouen station three new turbo-generating sets rated at from 30,000 kW to 35,000 kW, with the necessary boilers. E provides for the conversion of a d.c. five-wire distribution zone to a.c. F, estimated to cost 144,000,000 francs, provides for an increase of the transformer plant to correspond with the enlarged generating capacity. G will comprise, on the one hand, an extension of the distribution system and, on the other, the establishment of two new transformer stations to deal with energy at 60,000 volts. Finally, the H programme provides for an increase of the capacity at the Sud-Ouest central station to 120,000 kW. It is estimated that the total cost of the eight programmes, as outlined, will amount to the sum of 1,046,000,000 francs.

City Electricity Distribution Systems.

Aspects of their Design and the Problem of Standardisation.

By J. R. BEARD, M.Sc., M.I.E.E., and T. G. N. HALDANE, B.A., Graduate I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE paper is based on the belief that the future of electricity supply, particularly as regards the domestic load, will bring, not slow development, but rapid growth, which will at least double and possibly quadruple existing loads within the next 10 years. Its main object is, therefore, the design of a system suitable for adoption as a standard and to consider how far existing systems may gradually be brought into line with it, particular attention being given to the design of a system layout which facilitates expansion to deal with growing load.

Existing distribution systems throughout the country are already beginning to be overtaxed, and there is no doubt that in many cases large and radical extensions must shortly be made. Piecemeal extensions without any definite plan, such as have sufficed in the past, will be quite inadequate to meet the new situation.

Many authorities consider that standardisation would have a larger influence than anything else in cheapening and extending electricity supply. The ideal is that the consumer should never be troubled with technical questions of voltage or type of current, just as a gas consumer is never troubled with questions of pressure or calorific value. Main transmission, high-voltage supplies to individual consumers, and rural distribution are not discussed as they constitute quite distinct problems in themselves. Limitations to which the ideal standard system must be subject in this country are embodied in various regulations of the Electricity Commissioners, the Home Office, and of local authorities.

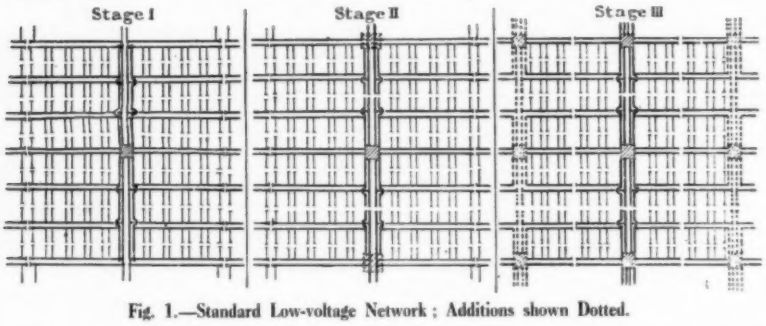


Fig. 1.—Standard Low-voltage Network; Additions shown Dotted.

It is desirable to investigate the design of the standard system for load densities ranging from about 400 to at least 25,000 kW per square mile, representing the demand on the main sub-station at time of peak. Over individual square miles figures of the order of 10,000 kW are reached in many instances, and in the exceptional case of the City of London the figure approaches 50,000 kW. On the basis of an annual increase of load of 15 per cent., the load density will approximately double in each 5-year period; it is, therefore, advisable to look ahead for 15 years.

Energy will be delivered from the generating stations as three-phase current at 50 cycles to a transmission system feeding a limited number of "main sub-stations," from which it will be distributed at a high voltage to numerous "transforming centres" feeding low-voltage networks from which supplies will be given to the consumers on the a.c. three-phase four-wire system at voltages of 400 between phases and 230 between phases and neutral. That is at least as economical in copper as any other method of giving domestic single-phase supplies at a given voltage to earth, and is also the most suitable method for supplying industrial power. A single network serving both purposes obviously costs much less than two networks of the same total capacity, and, further, diversity between the power and domestic loads probably makes the total network capacity less. A.c. meets the needs of consumers quite as well as, if not better than, direct current, except for a very few special types of motor drive. The latter can always be dealt with by local conversion and should not be allowed to affect the general decision. For the same lamp voltage the expensive converting plant required with the direct-current system would increase the overall distribution costs by from 20 to 40 per cent. (depending on the load density) even after making full allowance for the saving in labour charges due to automatically-operated sub-stations. There would also be difficulty in finding suitable accommodation for the converting plant in congested areas.

The standardisation of consumers' voltage is a very important factor in developing the use of electricity and in cheapening electrical appliances. It has been one of the factors in the great progress which has been made in America. The British Engineering Standards Association recently decided to adopt as a standard 400/230 volts, and it is understood that the Electricity Commissioners will require all new systems to conform with this new standard.

Low-voltage Distribution Lay-out. — The transforming centres, at which the low-voltage distribution system is fed from the high-voltage distribution system, have been assumed to be arranged in chessboard fashion, each centre feeding a self-contained low-voltage network covering an area in the form of a square the length of side of which corresponds to the spacing of the transforming centres. Provision is made by means of link boxes for coupling adjacent areas in case of emergency, or to deal with changes in the distribution of load. There is no difficulty in working on the low-voltage mains while they are alive, and under modern conditions the risk of serious breakdown is very small. Consequently, it is permissible to design the low-voltage networks on the basis of non-duplicate supply, both to individual consumers and to sections of the area, and for such conditions a radial type of network is most economical. A certain number of link boxes would, however, be provided so as to make it possible to split up individual sections and to feed these split-up portions from other sections. This provision would enable supplies to be resumed quickly after a network fault, except in its immediate vicinity.

The general distribution to groups of consumers is done from distributors laid along every pavement in the area. A certain proportion have their section increased to carry the load to the remaining distributors, in addition to their own load. The larger are "main distributors" and the others "sub-distributors." For the sizes of area which are the most economical, it is cheaper to deal with excessive voltage-drop by additional copper than by voltage regulators. The distributor type of network can deal with increased load with the minimum of modification to the cable system. It is obviously much preferable to deal with the increased load by increasing the number of transforming centres rather than by strengthening the cable network; this is assisted by the fact that it is possible to adopt a standard capacity of transforming centre over a large range of load density without appreciable sacrifice of economy. Fig. 1 shows the most desirable layouts of the low-voltage network for three stages of development.

At low load-densities the transforming centres are widely spaced and, therefore, the permissible voltage-drop plays an important part in settling the size of the cables employed. It has been assumed that, under the worst conditions, the drop in the low-voltage cable should not exceed 6 per cent., which is three-quarters of the maximum permissible variation of 8 per cent. The remaining 2 per cent. is allowed to cover drop in the high-voltage system and transformers.

Four-core cables should be used. The additional cost of making the neutral conductor the same size as the phase conductors is almost negligible and is desirable. Comparison strongly favours armoured cable; it will at least be no more expensive to install, its current-carrying capacity will be higher, and its maintenance costs will be lower, but the use of unarmoured, waterproofed, cables laid direct should be considered, especially for all purely residential or semi-rural areas.

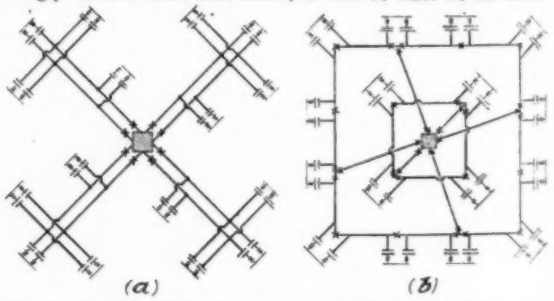


Fig. 2.—Simplified High-voltage Systems: (*a*) Radial-parallel Feeders. (*b*) Interconnected Feeders.

High-voltage Distribution Lay-out.—It is necessary that each important feed into the low-voltage system should be in duplicate. The cost of duplicate supply can be reduced by operating normally with both supplies in service and relying upon the emergency short-time overload capacity of the plant on the occasions when one of the supplies is out of commission. It is assumed that such an occasional overload can be 33 per cent. above the normal continuous capacity when dealing with the type of load to be expected in normal areas.

Simplified systems of feeding a group of transforming centres from a main sub-station are shown in fig. 2. These forms reduce the switchgear to the least possible amount, but can still be equipped with satisfactory protective apparatus. Whichever form be adopted, it is desirable to keep entirely distinct the systems fed from different main sub-stations. Pro-

vision should be made for linking adjacent systems in emergency, but the links would normally be kept open so that any exceptional trouble at a main sub-station, or on the high-voltage system fed from it, would only affect that part of the area of supply. Modern practice would assume that all high-voltage switchgear and busbars at the transforming centres could be omitted and the high-voltage feeders treated as extended transformer connections. Such a scheme could safely be recommended for an important supply of, say, 10,000 kVA capacity. The interconnected system shown in fig. 2 (*b*) is of a simplified type with only one high-voltage circuit breaker at each transforming centre on the rings. There are, of course, additional circuit breakers at the feeding points.

Although the radial system saves some 10 to 20 per cent. of the cost of the high-voltage cables and switchgear, these items only form some 10 to 15 per cent. of the total distribution costs. The decision must, therefore, be largely influenced by the relative security of supply afforded by the two systems. In the authors' opinion, there is little to choose. The radial system is, perhaps, more liable to have simultaneous trouble on both circuits supplying a group of transforming centres, and thus, on rare occasions, to cause a failure of supply over a considerable area. The interconnected system, on the other hand, will probably result in a greater number of shut-downs of individual transforming centres and a greater number of "consumer-hours" of interruption of supply. On the grounds of simplicity, ease of operation, and lower cost, the authors therefore prefer the radial system with three or four transforming centres per pair of feeders for the normal type of urban area with relatively high load density. At the same time, in suburban areas, local geographical considerations or uneven distribution of load may favour the interconnected system. This, indeed, may apply to any area which contains a large number of prospective large power consumers who will each require a high-voltage supply.

Voltage of High-voltage System.—Three possible alternative voltages for the cables from the main sub-stations to the transforming centres where the voltage is stepped down to 400 are: (1) The voltage of the main transmission system (usually 33,000 volts); (2) 11,000 volts, and (3) some still lower voltage, such as 3,300 volts. The choice rests between the first two and,

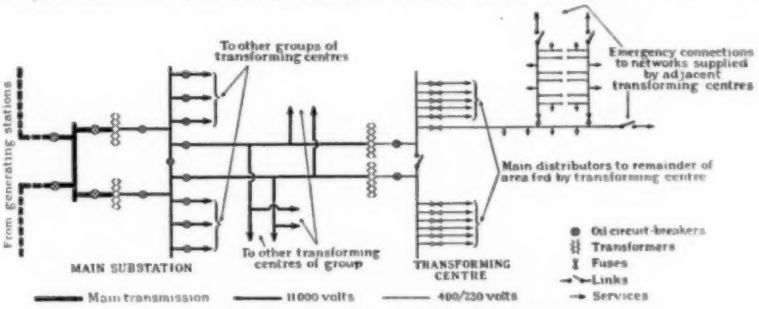


Fig. 3.—Proposed Standard Distribution System.

financially, there is a slight saving in favour of the first alternative; comparison would be slightly in favour of the second if it were made on the basis of capital costs only, ignoring losses. Apart from the financial aspect, the first alternative undoubtedly makes for a simpler system as it eliminates one complete transformation and reduces the number of transforming centres. The authors' conclusion is that 11,000-volt distribution is, on the whole, better suited for the conditions which have to be met now and in the immediate future. In areas which are already largely developed at 6,600 volts this voltage would no doubt be continued, as the disadvantages of a double-voltage system would outweigh the relatively slight saving of the higher voltage. The most economical spacing of transforming centres varies from about 0.7 mile at a load density of 1,000 kVA per square mile to 0.2 mile at a load density of 32,000 kVA. The variation of total cost due to varying spacing is comparatively small over a wide range. It is possible to adopt without departing from the 2½ per cent. limits, high and low, of the total annual cost, a spacing for Stage I which is twice that for Stage III. This procedure enables a standard size of transforming centre to be used through all the stages of development of a given type of area.

Standard System.—The main features of the proposed system are summarised diagrammatically in fig. 3. Its complete adoption is in most cases impossible; it is seldom justifiable to scrap existing networks, but a great deal can be done to incorporate some of its chief features and to ensure that as existing systems develop they tend gradually to approach the standard. The most important feature is that the lighting and domestic consumers' voltage should be standardised at 230, and a change-over of this sort, including any necessary modifications to the undertakers' own apparatus, ought not to add more than about 5 per cent. to the existing expenditure on distribution. On a growing load this would be rapidly offset by the reduced capital expenditure due to the higher distribution voltage. In direct-current areas where the power load predominates, a complete change-over is a very expensive matter and in no case which the authors have considered is it practicable to scrap the existing system entirely. In an area where the power load is developing rapidly it does, however, pay to superimpose a new standard system which would deal with all new load.

The most difficult problem arises where it is not possible to adopt the standard three-phase four-wire system without scrapping the existing cables; for example, when it is desired to convert a direct-current three-wire system. Such a case can best be dealt with by adopting a modified standard system in which the low-voltage distribution is single-phase three-wire. Single-phase two-wire systems which it would not be economical to scrap can best be dealt with by grouping the cables so that they can be fed from a skeleton three-phase four-wire network, the gradual growth of which would permit an increasing proportion of the power load to be supplied three-phase.

The authors have examined a sufficient number of typical cases to feel satisfied that the general conclusions are correct, although in any given case special circumstances have to be taken into account. They feel that not only is the adoption of a standard system for all future extensions of vital importance to electricity supply undertakings, but that a great deal more can be done than is commonly supposed in modifying and adapting existing systems. Indeed, the advantage in facilitating mass production must be so great that it might be worth manufacturers' while to co-operate with the electricity supply industry in a vigorous effort to establish standardisation. If, for example, manufacturers could offer some immediate advantage to the consumer as regards the purchase of standard apparatus, this would greatly influence supply undertakers in making such changes as are necessary to bring existing systems into line with the standard system.

Discussion in London.

Mr. R. A. CHATTOCK opened the discussion with the remark that the scheme suggested by the authors was development on ideal lines, which was being followed in Birmingham and elsewhere, too, but he did not contemplate scrapping his d.c. network as the paper suggested should be done. The authors assumed a "rapid growth of load" in the future, but he considered that it had already arrived; indeed, it had been with them for the last three or four years. Standardisation was a desirable ideal, but would it cheapen supply? Not for some years, he thought, because it involved scrapping capital. He could not see how an a.c. system could be superimposed on a d.c. network in a city area without scrapping the d.c. system and, therefore, capital; it would accordingly be better not to complicate matters by doing so. The author's suggestion was on similar lines to the Government's frequency-standardisation scheme, neither of which could be justified from the point of view of cost except in new areas. In comparing their "standard" system with the d.c. system, the authors had assumed that voltage regulation would not be necessary on an a.c. network, but his experience was that on the h.p. cables alone (not transformers) a variation of from 7 to 10 per cent. was not unusual; as a corrective he used induction regulators and considered it desirable to make them automatic in future; being costly, their use brought the a.c. and d.c. costs closer together. In a large city the lighting system must be reliable and stand-by batteries had fully justified themselves in densely populated areas. In cities reliability was the first plank on which to walk.

The PRESIDENT, Dr. W. H. Eccles, read part of a communication from Sir John A. Snell, in which he expressed his appreciation of some of the suggestions advocated in the paper.

Mr. C. P. SPARKS found himself in such close agreement with the authors' opinions that he had no criticism to offer. For years the B.E. Standards Association had been trying to get down to something that could be recommended; it had now reached a decision, and the paper endorsed it. Standardisation of the consumer's supply was the main thing; Britain had probably done more than any other country in standardisation; the U.S.A. had not done anything like as much, yet there they were adamant with regard to consumers' supply: 95 per cent. was standard, d.c. in the cities and a.c. outside them, so that consumers did not have to bother about type when they purchased apparatus. The growth of systems had rendered stand-by batteries unusable, since they cost much money and functioned for minutes only between long intervals. A.c. must be used to meet the density of demand that would be experienced in the future; in a part of London the load density was 50,000 kW per square mile, and he knew of another case in which the figure of 70,000 kW had been passed and was still growing; under such conditions there would be no room in the streets for the use of d.c.

Mr. S. J. WATSON said that one of the ways in which they measured the use of electricity was per head of the population. He believed the figure was at present about 150 kWh per head per annum throughout this country, but it would reach 600 kWh per annum in a few years, and the paper would assist those engineers who had to cater for such growth as that. In his area, Salisbury, there was a population of a quarter million in the 8 sq. miles of city area, plus 4 sq. miles outside, and the density of load was 2,500 kW in the city and 150 kW outside, which figures indicated the variation obtaining in one district, but there were others which were denser and would very soon reach the authors' figures. The authors' contentions with regard to voltages were sound, but in some suburbs an intermediate pressure between 11,000 volts

and the consumers' would be desirable. He agreed that the standard system should be a.c. where possible, though in many cities it would be financially impossible to change over. In his area he used a.c. on the fringes and worked it inwards, changing over large works, &c., to a.c. and so preventing the d.c. network growing. That keeping the neutral wire the same size as the outer wires was good practice had been proved by experience of domestic supplies. Not often could sub-stations be located where one would like them to be; he thought it desirable to have oil switches at the "transforming centres" in addition to those in "main sub-stations."

Mr. J. W. BURR felt that many systems were already overtaxed, and the time had arrived for engineers to take stock of their positions: nevertheless, many Town Councils would not allow them to extend mains unless they could see a return of 20 per cent. on the money so expended. Therefore, they had to limit the amount of copper desired to be put down, and complete networks could not be laid at once. Why had the authors fixed 400/230 volts as the consumers' maximums? Why not adopt the highest possible? The "feeder" system of distribution would be the easier from the point of view of maintaining pressure; the four cores of the cables should be alike, the neutral being of equal area. It would sometimes pay to use the draw-in duct method, and at others to lay cables direct in the ground. He had both radial feeders and ring mains in use and found the latter more flexible. It was possible, as the authors maintained, to do without oil switches at the secondary sub-stations, if precautions were taken. His experience of 33,000-volt cables had been most unhappy; faults took four times as long to find and repair. Why not generate directly at 11,000 volts instead of transforming up from 6,600 volts?

Mr. C. A. WARD considered the paper to be a guide, but thought cost reduction had been achieved somewhat at the expense of reliability; he would prefer to interconnect a little more than the authors advocated. Lead-covered cables in ducts appeared to be easier to extend than those laid direct. Too drastic alterations might be made for the sake of standardisation, considering that in 20 years' time present methods of distribution might be obsolete.

Mr. R. BORLASE MATTHEWS considered the psychology of the consumer to be of importance. The authors had not feared to advocate their ideas and there would be no difficulty in applying their well thought-out plans. It was useful to estimate load density per square mile in towns, but not so in rural areas, where it should be converted per route mile of cable. In future bulk supplies would be given at 33,000 volts, but the station engineer would not care for "outsiders to come direct on to his busbar." What was to be done in such cases?

Mr. A. PAGE welcomed the paper as a clarion call to action; it bore the imprint of careful study and its standard was very high. Moreover, it was opportune after the Electricity Commission's Advisory Committee's report on "Domestic Electricity Supplies and Methods of Charge." It was, however, of no use initiating campaigns to stimulate the demand for electricity while stations were not in a position to accept new consumers, which was unfortunately the position in many cases. A forward policy in that matter was wanted; caution could be overdone. Many distribution systems were antiquated; they had no doubt cost much money, but the paper "blazes the trail." The Electricity Commissioners' records indicated the average distribution cost in this country to be £38 per kW of maximum demand (in parts of London the figure was actually £60). What was going to be the fate of the consumer? Many engineers would "see the light" as a result of reading the paper. The conglomeration of systems in London and other large cities was "awful," and it would pay handsomely to change that condition of affairs: but he was not an advocate of wholesale scrapping; improvement could be carried out without it—standard pressure was overdue, other things could wait. The salient points of the plan outlined in the paper were sound. Regulation was a bogey, and therefore intermediate transmission was unnecessary. They had the greatest difficulty in obtaining suitable sites for sub-stations and would soon require compulsory powers for purchasing them; they already had such powers in the case of generating-station sites. The use of underground sub-stations would involve the cooling of 18,000 kW of plant in some cases, according to the paper, and getting a large number of cables away from such a site was not easy. With regard to the authors' h.p. distribution system, a little more money would be warranted to make it more reliable. It was strange to hear the "high priest" of interconnection advocate the use of the radial feeder system.

Mr. J. R. BEARD, in reply to some of the points raised, pointed out that the superimposition of an a.c. system on an existing d.c. network was not difficult; in fact, it was already being done in Birmingham and other places where large consumers were being supplied with a.c. at 6,600 volts. It would, however, be too much of a step in the dark to abolish d.c. at once; the plan being carried out at Salisbury was the sort of thing they had in mind. The importance of a battery as a stand-by to a large d.c. system was fading away. He was glad to hear of the decision referred to by Mr. Sparks; the standardising authorities' task now was to get their decision adopted. In *The Times* it was recently announced that the Economic Sub-Committee of the Imperial Conference had completed its consideration of the subject of industrial standardisation, which had yielded interesting information about the extent to which a policy of standardisation had already proved of value. . . . It was reported to the Sub-Committee that the value of stocks of electric lamps outside factories was said to approach £4,000,000, and it was stated that the ultimate effect of the unification of pressures might be to reduce that amount by at least one-half. In parts of Chicago, U.S.A., a load density of 200,000 kW per square mile had probably been reached by now, but such very dense loading would obviously call for special treatment. Regarding the cooling of underground sub-stations, he knew of transformers of much larger capacity than those suggested in the paper being successfully kept cool by quite small fans. Did the addition of switchgear make for reliability?

Correspondence.

***Correspondents should forward their communications* at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The Earthing of Radio Aerials.

In reply to the points raised by Mr. T. C. Gilbert in your issue dated October 29th, ideals are unattainable, and no set of rules is beyond criticism; they represent authority, but do not necessarily depict truths, and should not be accepted in this sense. The excellent sets of Rules on Earthing* recently issued by the U.S. Bureau of Standards, are obviously wrong in certain particulars and of doubtful value in others.

Radio aerials should preferably have an "earth" which is distinctly separate from water or other metallic pipe systems, not only for the reduction of the p.b.s., but also for the minimisation of interference by neighbouring oscillators and atmospherics. This should be clear on consideration of the broadcasting problem dealt with on p. 784 of the ELECTRICAL REVIEW of May 18th, 1923, and of the case reported in the *Daily Mail* of April 4th, 1924, of servants hearing voices and music from 2LO being reproduced by the flame of the kitchen gaslight.

"Earthing" is a relative term, and all matter from the Heaviside layer inward may be said to be earthed. Specific earthing should be carried out only so far as may be necessary to accomplish the purpose in view; further earthing increases danger.

Given an inverted "L" radio aerial which is a fixture at the distant end, it is an easy matter there to fix a spark-gap and direct earth connection when erecting; this results in the aerial being isolated in so far as radio reception is concerned, and earthed from the point of view of a flash of lightning. If, however, the aerial is provided with a halyard at the distant end, equal isolation and simultaneous earthing may be attained by the use of a stranded-wire halyard and a single insulator, provided that the lower end of the halyard is attached to an earth connection, which, in the event of an iron pole being used, may simply be the pole itself. An egg insulator of usual type is no bar to a flash of lightning.

At the lead-in end and outside the house a spark-gap should be fitted, giving as direct a path as possible to earth. If the aerial is struck by lightning, both spark-gaps will be crossed with explosive violence. If the lead-in spark-gap is attached to the brickwork of the house, probably a few bricks may be dislodged and broken as well as the gap. This damage might be averted by a heavy switch fitted in parallel with the gap, both of which should preferably be fitted on a post three or four feet from the wall of the house and directly earthed, the lead-in to the house from the upper side of the gap having a few inductive turns.

Whether the switch referred to in the last paragraph is open or closed, the p.b.s. is the same; but the closing of the switch lessens the probability of damage either to the house, the spark-gap, or the radio receiver.

A radio aerial may or may not be fused on being struck; everything depends on the current and duration of the particular flash. In the case at Dunoon on the evening of the 23rd ult., no mention was made in the newspaper reports of the fusing either of the aerial or earth wire, though the "set" was blown to bits, wood ignited, and a hole blown in the gas-pipe most adjacent to the hot-water pipe to which the earth wire had unfortunately been attached.

E. Isherwood.

Saltcoats, *November 5th*, 1926.

Electricity (Supply) Progress.

The critics of electricity supply in this country are fond of saying that we are very backward, as compared with other countries. This is not the case if all conditions are taken into account. It is a fact that, at the present time, the progress of electricity supply, despite depressed trade, is proceeding at a very rapid rate. Some figures of progress may be interesting.

During the war, under Government control and to meet munition requirements, the amount of power in the principal generating stations in this country was increased from one million kilowatts to two millions.

In 1919 the Electricity Commissioners were appointed, one of their duties being to see that no inefficient generating stations were established or extended, and under their control, according to the official reports which they have issued, the amount of generating plant was extended in six years from two

*Safety Rules for the Installation and Maintenance of Electrical Supply Stations and Electric Utilisation Equipment. Handbooks of the U.S. Bureau of Standards, Nos. 6 and 7. 1926.

million kilowatts to five millions, or 2½ times the amount available at the end of the war.

During the last five years the sale of electricity in this country has been doubled, and that at a time of increasing trade depression.

The domestic supply of electricity is proceeding by leaps and bounds at an unprecedented rate.

It may be said with certainty that so soon as trade revives in this country there will be another substantial jump in the use of electricity, and all this is proceeding without the aid of the Government Bill to establish a bureaucratic body whose duty it will be to expend large sums of money, to indulge in State trading, and to control the management of other people's businesses at the other people's risk. Surely, as a result of the financial catastrophe consequent on the coal strike, the Government will pause before they rush this Bill through and will give an opportunity to those in the industry who oppose it to put their views forward.

W. B. Woodhouse.

Leeds, *November 2nd*, 1926.

The Rent Meter.

A correspondent signing himself "Anticreep" has been at some pains to find objections to the new type of meter of which particulars were published in your issue of October 1st. Whilst the answers to most of his points are fairly self-evident, they had better all be given.

Size and Weight.—The meter is of the same size and of rather less weight than a two-element polyphase meter, and is not heavy or bulky in comparison with most d.c. mercury meters.

Shunt Losses.—"Anticreep" need not distress himself at the possibility of shunt losses being included in the registration. This is purely optional, and the losses are either included or not, at the discretion of the supply authority. Ultimately, of course, the consumers as a whole have to pay for shunt and all other losses on the system, regardless of what method of charging is employed.

Variation of No-Load Speed on Varying Voltage.—If the rent meter were merely an ordinary induction meter running on shunt at no load, the speed at no load would vary as the square of the voltage and this would rule out the meter as a practical instrument. The question of voltage variation received full consideration in the design of the rent meter, and its speed at no load is independent of voltage variation in a commercial sense.

Effect of Varying Friction on No-Load Speed.—The no-load speed of the rent meter is a definite function and the torque at no load is of a high enough order to be ample for overcoming friction. Later on "Anticreep" concedes accuracy within 1 per cent. at 1/20th load for an ordinary meter, and he may rest assured that the rent meter, which runs normally on no load with a greater torque than the equivalent of 1/20th load for an ordinary meter, will have a smaller error due to frictional changes.

Accuracy Curve.—The argument here is a result of confusion of thought. No compensation is required as suggested. With an ordinary meter the shunt losses cannot be included in the registration. With the example cited by "Anticreep," *viz.*, a 2½-A 200-V meter at 1/20th load, the supplier is paid for 25 watts against energy supplied of 25 watts plus meter shunt losses, which, if put at 1½ watts, means 6 per cent. more energy supplied than paid for.

With the rent meter the no-load speed either includes the shunt losses or does not. The point has no bearing whatever on the accuracy of the record when a load is applied. If the fixed charge, which may or may not include shunt losses, is an amount which is represented by, say, 3 r.p.m. on the meter, then the meter will rotate at 3 r.p.m. at no load and the question of the shunt losses has been disposed of once and for all. When load is applied the speed of the meter will be 3 r.p.m. plus whatever rotation is caused by the load. The shunt losses cannot possibly influence the added speed due to load.

Object of Rent Meter.—Apart from other uses, the object of the rent meter is to give an accurate record of the energy consumed over such a wide range of load as to enable a single meter to be used for lighting, heating, and power under a two-part tariff. The alternatives are either to have separate meters for each class of load or else to employ one ordinary large-capacity meter and be content with relatively inaccurate records at low loads. The high degree of accuracy of the rent meter on low loads is attained through the meter rotating on no load, and this constant rotation is a convenient means of recording the fixed part of the tariff.

My critic seems to agree with the use of rent meters for prepayment consumers, and this, of course, is an important use to which the rent meter will be put in due course; but if he can approve the system for prepayment consumers, I fail to see his difficulty in the case of quarterly consumers.

The Consumer's Point of View.—The rent meter carries a brass plate which states that the rotation at no load represents the fixed charge. If he can understand what a fixed charge is, he can surely understand that this can be recorded by means of constant rotation.

Calibration.—The calibration of a rent meter is an extremely simple process. As regards load measurement, no question arises at all. As regards the no-load speed, this is varied by turning a micrometer screw one way or the other. The idea that every consumer would have to have a specially calibrated meter is of course absurd. The fixed charge would not be calculated by counting the number of bricks in each house, but by more arbitrary methods, and there need be no more steps in the scale of fixed charges than there are in the sizes of meters.

Alteration in Charges.—It should be borne in mind that the no-load rotation is a constant and at the end of every quarter it is quite easy to determine how much of the reading is due to the fixed charge and how much is for energy actually consumed. It is possible, therefore, to vary charges to any extent without re-calibrating the meter, but if it should be desired to have a direct reading on the meter instead of applying discounts, the no-load speed can be varied with the greatest possible ease. Moreover, the no-load rotation—being a constant—can be deducted from the quarterly reading, and the resultant load consumption, which will have been recorded with far greater accuracy than is possible with an ordinary meter, can be charged for under any desired tariff.

R. Amberton.

London, *October 30th*, 1926.

The Remuneration of Engineers.

"The fault, dear Brutus, lies not with our stars, but in ourselves, that we are underlings." Ourselves in the collective sense, of course.

I suggest the formation of a "Centre Page Society," composed of all who apply for positions advertised in this journal. The secretary of the Society would tell members the minimum salary to ask for any position, and blacklegs would have the REVIEW stolen from their doorsteps by pickets. There would be a subscription; no great scheme is perfect.

Allow me to blush unseen as

Concerted Action.

October 30th, 1926.

Selling Electricity.

As Service Agents for the Manchester area for the Kelvinator automatic electric refrigerator, we cannot let Mr. R. Hardie's figures on page 797 pass without protest.

He gives 800 kWh per annum for a domestic refrigerator, whereas our experience is that 400 kWh is nearer the mark! Actually, in the case of our showroom model, which is about 25 per cent. larger than the domestic one, and which is in a quite comfortably warm showroom, where the doors are opened dozens of times each day for demonstration purposes, the actual consumption, as registered by a Manchester Corporation meter, was 47 kWh in 41 days, the compressor being left connected day and night the whole time. During this period the three ice trays were emptied and filled twelve times with fresh water in order to get something like normal conditions.

If Mr. Hardie's figures are correct, the domestic refrigerator that he refers to must be hopelessly inefficient. With electricity at 1½d. per kWh there is a saving of fifty shillings per annum in favour of the Kelvinator.

E. O. Walker & Co.

Manchester, *November 1st*, 1926.

Consulting Engineers and Specifications.

I have recently handled a specification for a very large job in the Midland territory, and under the heading "Protection of Wires," the consulting engineer has specified:—

"The wiring throughout from the distribution boxes through the switches to the lights to be done on the latest lines."

Surely contractors are entitled to more guidance than this.

A.M.I.E.E.

Birmingham, *November 1st*, 1926.

Wiring for Domestic Appliances.

I see your issue of October 22nd featured "Domestic Appliances," yet in your issue of July 9th, when that vital factor—the cost of wiring—was brought up in the "Correspondence" column, nobody troubled to answer.

It is, no doubt, this apathy on the part of the supply companies which has allowed the very loose framing of the wiring rules on this matter.

In the letter referred to above your correspondent suggested that a house might be wired with five heating plugs (capacity not stated), all looped together and fed from a 15-ampere combined main switch and cut-outs. In the circumstances quoted, that wiring is quite feasible. But what happens when the consumer cuts out the coal fire or the central heating, or some elderly person comes to stay, and more heat is required? In goes a 4-kW fire, and up goes the installation.

I suppose all of us have come across the builder's job, wired with two or three points to the circuit, in 3/.036 cable, with 10-ampere Continental switches and plugs, and have seen the resulting charred plug tops and burnt-out switches. Yet the contractor could not quote for anything better, or he would have been turned down.

I have in mind a job wired on these lines which worked a bowl fire and a 2-kW radiator very satisfactorily for the customer. Then he sold the house. The new owners were chilly mortals, and bought fires that *were* fires. All the plugs smoked, the switches were too hot to touch, and the conduit was like a hot-water system running round the house.

Yet can one altogether blame the contractor?

My own system is to wire each point on to a separate 15-ampere circuit on the fuse-board in 7/.029 gauge cable, with a first-class 15-ampere switch and plug. It makes an expensive

job in C.M.A. lead cable, but when it is done I feel safe. But I lose a lot of work on price.

Then again, one is confronted with the question of connecting vacuum cleaners, fans, toasters, &c., to the heating circuit. Obviously they should have less than a 15-ampere cut-out for protection. Yet, with two rates of charge, this is impossible unless special wiring is put in.

My system is to wire a 10-ampere plug and switch with a 10-ampere china cut-out on one pole, looped out of a heating plug. This entails an unsightly conglomeration of gear on the skirting, but there appears to be no alternative. The only fit appliance for adapting heating to small apparatus reduces the 15-ampere to the 5-ampere size, and would allow the customer to plug in standard lamps, which is not admissible on two rates of charge.

It seems a pity that some accessory is not designed to overcome this difficulty more simply.

The above may seem trifling matters to the station engineer. Yet the domestic load is a very big question, and the wiring, as regards both safety and price, is every bit as important as the generation of the current.

New Barnet, *November 3rd*, 1926. **P. M. Braidwood.**

Electric Cooking.

In an article which appeared in your issue of October 22nd, on the above subject, we were pleased to read a reference to the efficiency of the "Quead" boiling ring.

In this connection may we remind you that the "Quead" electric oven to which you referred in an issue during 1925 is similarly remarkably efficient? For example, it requires only half a unit of electricity to cook an average meal consisting of, say, a 5-lb. joint (roasted) and a suitable supply of roasted potatoes and baked puddings, tarts, &c.

London, *November 1st*, 1926. **Wm. Geipel & Co.**

Inside-Frosted Lamps and Shadows.

Certain electric lamp manufacturers are to be congratulated on having solved the problem of inside-frosting bulbs. It is well known that with the advent of high-efficiency tungsten lamps, the manufacturers endeavoured to conceal the bright filaments by etching or frosting the bulbs.

Those of us who have had experience with bulbs frosted on the outside well know how they harbour dust, and how, after a short period of service, especially in works, they become brownish in colour and consequently wasteful of light.

The inside frosting of lamps has certainly overcome these objections, but I would like to point out one important factor regarding them, that is—the maker's stamp on the lamp.

During the past month these lamps were installed in a pottery, and it is interesting to note that the ones now in use have the maker's mark on the base of the lamp (tipless lamps, of course). This mark casts a shadow on the ware—particularly china ware—so much so, that the lamp-maker's name is actually reflected on the ware; consequently decorators, sorters, and examiners, find it extremely difficult to do accurate work.

Is it not possible for the maker's name to be stamped on the side or neck of the lamp, as in the case of many of the clear type?

Hanley, *November 1st*, 1926. **A. Douglas.**

The B.E.S.A. Glossary.

Having had to devote some time to the study of the Glossary in view of its bearing on our work here, I have been particularly interested in the discussion which has been going on in your pages, from the criticisms at the B.A. meeting onwards.

One point has been recalled to my mind by the letter from Prof. Howe in your current issue. He states, in effect, that of all terms used in the past none have suffered more than the word "force." In view of the fact that he makes it mean "work," I am inclined to agree that "force" is, indeed, a badly treated word.

In your report of the B.A. meeting (August 27th, page 358, column 2, lines 4 and 5) Prof. Howe is made to say ". . . the m.m.f. around any closed path is the work done. . . ." Lines 6 and 7 from the bottom of the same column ". . . the electromotive force around any circuit is simply the work done. . . ."

It is possible that the definitions given in the Glossary are not very happily worded, but I submit with respect that Prof. Howe's suggestion is definitely wrong.

Force is not work.

The work, in ergs, in bringing a unit north pole from an infinite distance up to any given point in a magnetic field, against the forces due to any system of magnets, represents the magnetic potential at that point.

The unit of magnetic potential is such that one erg of work has to be done on a unit north pole in bringing it up to a point at unit potential from an infinite distance.

The work done on a unit magnetic pole as the latter passes once round a closed path or magnetic circuit, linking with any electric circuit, is a measure of, and in suitable units is numerically equal to, the m.m.f. of the circuit. If the work is expressed in ergs, it is numerically equal to the m.m.f. in gilberts.

I trust that neither you nor Prof. Howe will accuse me of quibbling when I state that this is totally different from saying that "the m.m.f. is the work," &c.

Similarly, in the electric case, the work done in bringing a unit positive charge from an infinite distance to any given point against the forces due to any system of electric charges represents the electrostatic potential at that point. It is generally referred to simply as the potential of the point.

To come down to practical terms, the total e.m.f. in a circuit, in volts, is numerically equal to the work, in joules, done on a positive charge of one coulomb as the latter passes once round the whole circuit.

This again, to my mind, is quite different from saying that e.m.f. is work.

I would not worry you on this point but for the fact that Prof. Howe emphasises his viewpoint as a teacher; and as a teacher he claims that the people who deal with these things from the teaching end should have a hand—or a voice—in standardising the definitions. To that extent I quite agree.

I am pleading from the students' point of view, and anything but perfectly definite, unambiguous wording of definitions is to be deprecated. To most students these definitions occur in their first (electrical) year in any college, in some cases in their second college year. Many of them have some conception of force, power, and work, in the purely mechanical sense. An ordinary man can visualise 33,000 lb.—it's about 15 tons. He can look at a loaded railway truck, for instance, and get an idea of what it all means. He knows what 1 lb. is. If cigarettes are a shilling an ounce, he can realise that the cost of 1 lb. of cigarettes in shillings is numerically equal to its weight in ounces, and he would never be guilty of saying that a shilling is an ounce.

There are very few first-year students who can visualise a dyne, a joule, or an erg. If a teacher tells them that in certain cases dynes are ergs they will believe him—and live in a fog for years.

The Glossary is an honest attempt to standardise electrical terms. It is wanted, and I, for one, welcome it. If the teachers were not sufficiently represented in its preparation, by all means draw more of them in for its revision; but, whatever happens, let the teachers remember that what is perfectly clear to them is not necessarily clear to students, and in defining physical quantities a form of words which may be good enough for a lecture is not necessarily good enough to be written down as a standard definition. Absolute accuracy is essential, in phraseology which cannot be misconstrued.

I have no axe to grind. I was not, and never am likely to be, consulted as to the Glossary.

Francis Thos. Fawcett.
INTERNATIONAL CORRESPONDENCE SCHOOLS, LTD.
London, *November 8th*, 1926.

The Electric Vehicle and Charging Facilities.

Two references to electromobiles appearing in your issue of the 5th inst., and another reference in your report of the I.E.E. presidential address in your previous issue of 29th ult., prove interesting reading to those who espouse the cause.

One feels that if only the electricity supply engineers as a whole had devoted more attention to catering for the electromobile we might have heard less of the poor-load-factor argument which was so prominent in the initial stages of the Electricity (Supply) Bill, several professing that the only means of cheapening the cost of electricity was the erection of costly long transmission mains from a few super bulk supply stations together with interconnection of some existing stations, and the scrapping of poor-load-factor stations—such transmission mains being unremunerative throughout the greater part of their length for some years to come. Even so, one has still to face the load-factor problem.

The president of the I.E.E., in his address as reported, says: "It is doubly regrettable that a form of transport which avoids the importation of fuel from abroad, and which positively improves any load factor, is so neglected in this country."

Mr. R. Hardie states that in the United States "one central station derives a revenue of £120,000 per annum from the sale of energy for battery charging."

Mr. T. N. Cross states: "The station engineer has hitherto ignored the 'electric'." "The total increased load in New York alone runs into some millions of units."

Experience has proved the necessity of an Association in which everyone—whether they be statutory electricity supply authorities, gas undertakings, factories, hotels, emporiums in possession of an electricity generating plant which can be adapted—can be enrolled together with users and all others interested, to mutual advantage.

In view of the standardising of a.c. working throughout the country, one has to consider the cost of conversion to d.c. for charging purposes. Several private plants are on the d.c. system already.

I have estimates for such a supply from two statutory authorities in London; in one case, a d.c. supply, the price for energy is well under one penny per unit, in the other, an a.c. supply, the price is one penny plus 25 per cent., added to which is the cost of a suitable transformer chamber, &c.!

It is necessary to have more than one charging and replacement battery station in every city and town in the United Kingdom, and the sooner we get down to uniformity in battery-crate dimensions the better for quick replacement purposes. In this respect "under-slung" type batteries appear to be the best solution for both freight and passenger electromobiles.

In conclusion, users will find it to their advantage to combine efforts in the growing membership of the Electromobile Association—the only Association devoted exclusively to electromobiles, land and marine—towards gaining the fullest benefit from the adoption of electromobiles, besides cheapening the first cost of the vehicles. Makers will also find it mutually advantageous as members to meet user and prospective user

members on a common ground, so as to bring concerted influence to bear on the provision of more numerous charging and replacement battery stations at moderate charges in the U.K.—the Association to negotiate, where necessary, with those electricity supply authorities which have not yet fully appreciated the mutual benefits arising from the "refuelling" of electromobiles at times other than peak loads, and, failing satisfaction in that direction, to adopt other measures to assist users who are members in obtaining energy at suitably-located sites and at reasonable tariffs—in several instances members who are fortunate in possessing their own charging plants aiding their brother members.

J. C. Elvy.

London, *November 8th*, 1926.

Electricity Supply in 1924-25.

Return of Engineering and Financial Statistics Prepared by the Electricity Commission.

LAST week a volume of Returns, supplementary to the one issued last year for the years 1921-23, was published (H.M. Stationery Office; price 15s. net). It covers the two years ended March 31st (or May 15th), 1925, for local authority undertakings, and December 31st, 1924, for company undertakings. Like the previous volume, it is divided into two sections, "Engineering" and "Financial"; it deals with 563 authorised undertakers, of which 338 are local authorities and 225 companies. As a result of the authorisation of 57 new undertakers and the transfer or revocation of powers in 29 cases, there is a net increase of 28 undertakers (12 l.a. and 16 c.), as compared with the period covered by the previous return. At the end of the period 52 undertakers had not commenced supply, but as some undertakers operated more than one undertaking, there were in all 541 undertakings in operation. Local generation was employed in 420 cases; supply wholly in bulk in 121, of which 71 were l.a. and 50 c. undertakings.

At the end of the year 1924-25 there were in Great Britain 494 generating stations, with a total installed capacity of 3,723,514 kW; local authorities owned 281 stations of 2,529,320 kW, and companies 213 stations of 1,194,194 kW, the net addition during the two years being 629,835 kW. The stations ranged from 15 kW to 106,750 kW installed (Stuart Street station, Manchester Corporation). The 42 largest stations contained 1,886,690 kW of plant—50.6 per cent. of the whole; 109 stations contained 2,969,602 kW—80 per cent. of the total. Of the rest, over 200 stations had an installed capacity of less than 1,000 kW each. Of the total, about 90 per cent. of the plant was driven by steam turbines, 8 per cent. by reciprocating engines, 1¼ per cent. by internal-combustion engines, and 0.22 per cent. by water power; 90 per cent. was a.c. and 10 per cent. d.c. Of the 494 stations, 151 generated a.c. only, 236 d.c. only, and 107 both a.c. and d.c. In most a.c. cases the system was 3-phase, 50-cycle, at 6,600 V, but 21 undertakers (2 l.a. and 19 c.) used generating voltages of 10,000 V or more. Fourteen frequencies were in use, of which 50 cycles predominated (231 stations); 25 cycles was used at 17 stations and 40 cycles at 10. The percentages (of the total a.c. plant installed) were 50 cycles 76.7, 25 cycles 12.9, 40 cycles 7.1, and all other frequencies 3.3 per cent. The aggregate rating of the boiler plant installed was 54¼ million lb. per hour, from and at 212 deg. F.

Distribution systems of 539 undertakings were divided as follows:—A.c. only, 145; d.c. only, 191; a.c. and d.c., 203. Two other undertakings gave supplies for public purposes only. The declared pressures employed were: a.c., 400 V (136 cases), 230 V (121), and 200 V (64); d.c., 230 V (130 cases), 460 V (110), 220 V (92), 240 V (72), and 480 V (68). In 111 cases a.c. supplies were given at 400 and 230 V, and in 110 cases d.c. at 460 and 230 V. Between 100 and 480 volts inclusive, there were 38 different voltages in use; 168 undertakings were supplying at 3 or more declared pressures, 88 of these at 4 or more, and 19 at 5 or more.

The kWh generated in 1923-24 amounted to 5,288.7 millions, and in 1924-25 to 6,022.2 millions, an increase of 32.6 on the figures for 1922-23; steam plant produced 98 per cent., i.e. engines 1 per cent., and water-power 0.26 per cent., the remainder being due to refuse destructors, waste heat, &c. The kWh sold to consumers in 1923-24 amounted to 4,467.5 millions and in 1924-25 to 5,097.3 millions, an increase of 35.5 per cent. on the sales for 1922-23. About 69 per cent. of the output was supplied for power, 20 per cent. for domestic uses, and 9 per cent. for traction. About 79 per cent. of all the undertakings sold less than 10 million kWh each, 51 per cent. sold less than 50 kWh per head of population, 22 per cent. over 50 but under 100 kWh, and 19 per cent. from 100 to 200 kWh; 3.6 per cent. sold 200-300 kWh and 3.8 per cent. 300 kWh and upwards per head. For the whole country, estimating the population at 43.6 millions in 1924, the sales by authorised undertakers in 1924-25 averaged about 117 kWh per head, as compared with 88 in 1922-23; these figures which relate only to the public supply of electricity, do not constitute an accurate measure of the total consumption of electricity in Great Britain, owing to the existence of numerous stations not belonging to authorised undertakers, at which large supplies are generated for traction, colliery and other industrial purposes. About 81 per cent. of the gross public supply generated (including 4.3 per cent. purchased from outside sources) was ultimately sold to consumers, the remainder being used on works, lost in transmission, &c., and unaccounted for. Bulk supplies amounted to 7.6 per cent. of the total. The aggregate of individual maximum loads on the authorised undertakings in 1924-25 was 2,558,621 kW, or 60 W per head. The maximum loads on generating stations aggregated 2,298,182 kW. The ratio of the aggregate maximum loads to the capacity of plant installed in 1924-25 was about 100: 162. Load factors ranged from 7.3 to 62.3 per cent. In 1924-25 13 undertakings had load factors of 45 per cent. and over, and 81 of 30 per cent. and over; but out of 521 undertakings 365 had load factors between 15 and 30 per cent. The combined load factor for the whole of the generating plant was estimated at 30 per cent. in 1924-25, comparing with 28 per cent. in 1922-23.

The total load connected to the systems of local authorities in 1924-25 was 4,281,206 kW, and of companies 2,153,736 kW, making a grand total of 6,434,942 kW—150 W per head of population; the ratio between the aggregate maximum load and the total load connected is of the order of 1: 2.5.

In 1924-25 the coal and coke consumed by electrical undertakings amounted to 6,661,500 tons; the oil fuel to 52,000 tons (15,400 tons of which was used by oil engines); and the gas from external sources to 1,758 million cubic feet. The average consumption of coal and coke, and fuel oil expressed as equivalent coal, for raising steam, was 2.71 lb. per kWh generated in 1923-24 and 2.55 lb. in 1924-25, showing the effect of the increasing proportion of modern plant in promoting economy. It is pointed out that there was an all-round economy of 26 per cent. in 1923-24 and of 34 per cent. in 1924-25 in the utilisation of fuel as compared with the position in 1920-21. During the year 1924-25 27 undertakings generated 1,000 kWh or more per ton of fuel consumed, as compared with 11 in 1922-23, the average consumption ranging from 2.24 to 1.75 lb. per kWh generated.

At the end of 1924-25 the loans sanctioned in the case of local authorities amounted to £127,401,430, and loans raised to £114,087,565; the net debt was £70,075,675. In the case of companies, at the end of 1924 the capital raised amounted to £57,901,028. The total capital expenditure at the end of the period of local authorities was £125,312,527, and that of companies £68,707,131, making a grand total of £194,019,658. During the two years local authorities expended £21,834,700, and companies £13,960,622.

Broadly speaking, 46 per cent. of the total outlay was expended in respect of generation, and 54 per cent. on transmission. The average capital expenditure on generation alone was £23.6 per kW installed, and on the complete undertakings £52.1 per kW.

The revenue from working in 1924-25 was (l.a.) £25,563,503, an average of 1.80d. per kWh, and (c.) £15,350,773, an average of 1.71d. The revenue from working per £100 of capital expenditure fell from £24.6 in 1921-22 to £21.1 in 1924-25, but the ratio between the energy sold to consumers and the total capital expenditure increased, showing the effect of reductions in charges for energy. Whilst the sales of energy for power were about 3½ times those for lighting and domestic purposes in the two years, the two classes of load produced, respectively, about 49 and 42 per cent. of the total revenue from sale of energy, together accounting for 91 per cent. The average revenue per kWh for all classes of supply in 1924-25 was nearly 30 per cent. lower than in 1921-22.

Working expenses in 1924-25 amounted to £23,409,893, or 1.01d. per kWh—57.2 per cent. of the revenue. Fuel accounted for 30 per cent. of the working expenses (which do not include capital charges); generation represented from 49 to 50 per cent. of the working expenses. The average cost of generation in 1924-25 was 0.46d., of which 0.29d. was for fuel. The average cost per ton of coal in 1924-25 was 20s. 8d., and of oil 73s. 9d.

Local authorities showed a gross surplus in 1924-25 of £11,009,356, and companies £7,419,509—total, £18,428,865. In the case of local authorities, interest charges and loan repayments absorbed 71.5 per cent. of the surplus, 11.1 per cent. was applied to capital expenditure, and 6.8 per cent. was allocated in relief of the rates. The companies paid in interest and dividends 53.3 per cent. of the surplus, and transferred 41.9 per cent. to depreciation and reserve funds; the average rates of dividend were 5.61 (pref.) and 9.25 (ord.) per cent.

At the end of 1924-25 the balances in hand of depreciation, reserve, and renewals funds were (l.a.) £5,090,357 and (c.) £13,535,763, total £18,626,120. The local authority figure is exclusive of the balances of the sinking funds.

Local authorities employed 26,863 staff and workmen, and companies 14,529, the total salaries and wages accounts being £4,821,000 and £2,557,000, respectively—a total of £7,378,000. About 11 persons were employed per 1,000 kW of generating plant installed.

Wireless Exhibitions.

Manchester. — The third annual wireless exhibition organised by the *Manchester Evening Chronicle* was opened in the City Hall, Deansgate, on October 26th, the ceremony being performed by Sir William Noble with Dr. S. Z. de Ferranti in the chair. The popularity of the exhibition in 1925 resulted in a larger number of firms taking space, and this year there were about 80 exhibitors, and an additional building had to be utilised for the concerts. A feature of the show was the constructional competition organised by the *Evening Chronicle*, for which prize money amounting to £500 was offered. Messrs. Lewis's, Ltd., drapers and furnishers, completely furnished a "wireless house" in which were installed sets in keeping with the styles of the rooms. Another

interesting feature was a demonstration of wireless as utilised by the Army in the field. Mr. J. L. Baird gave personal demonstrations of his television equipment.

Messrs. Ferranti, Ltd., had a "public address" system erected in the gallery, from which all the loud-speakers in the hall, numbering about one hundred, were operated. On the Company's stand in the centre of the Exhibition itself were several interesting features, including a new milliampere meter, a 2½-in. super-scale moving coil instrument with the exceptionally low consumption of about 150 microwatts. It can be supplied in either amp., volt, or milliamp. types, and will be ready for public sale in a fortnight. It is said that the scale is 25 per cent. longer than that of any other instrument. The Company will also be introducing a new and improved loud-speaker in from two to three months' time, and this was being utilised for the public speaking in the hall. Early inventions of Dr. Ferranti's were also on view.

The Hart Accumulator Co. showed batteries. For h.p. work it drew attention to the "Rao" and "Ray" models, which are so arranged as to provide a particularly compact unit.

The Igranic Electric Co. had a complete range of products, including the "Neutro-Sonic Seven" receiver.

Metro-Vick Supplies, Ltd., showed the new "Cosmos" resistance coupling unit and a range of standard products.

Philips Lamps, Ltd., had a full-wave rectifier which charges l.p. accumulators from a.c. mains at 2/12 volts, 1.3 amps. It was also drawing attention to the h.p. supply unit.

The Chloride Electrical Storage Co., Ltd., had a full range of batteries of every description, whilst the Lancashire Dynamo and Motor Co. showed constant-potential battery-charging outfits. Many other interesting exhibits were to be seen, amongst which may be mentioned those of Belling & Lee, Northern Steel and Hardware Co., S. H. Collett Manufacturing Co., Carborundum Co., C. A. Vandervell & Co., Ward & Goldstone, Ltd., J. J. Eastick & Sons, Falk, Stadelmann & Co., Tungstone Accumulator Co., H. Clarke & Co., Oldham & Son, Ltd., Mullard Wireless Service Co., A. C. Cossor, Ltd., and the Marconiphone Co.

Dublin.—The Wireless Exhibition which was arranged in Dublin by the recently-formed Irish Radio Traders' Association, Ltd., was held last week at the Mansion House. The display was very comprehensive and well attended. Special programmes were broadcast through the Dublin station. The opening ceremony was performed by Mr. J. J. Walsh, Free State Minister of Posts and Telegraphs, who referred to the great progress of wireless in Ireland since his Department had obtained control. He said that when they opened their Dublin station, 2RN, they had everything to learn. Among the projects that they had definitely in hand or in project were the establishment of stations in Cork and at other suitable points throughout the country. A vote of thanks to Mr. Walsh was adopted on the motion of Mr. G. Marshall Harriss. The following is a list of exhibitors:—Mr. A. G. Bruty, Messrs. Houghton-Butcher, B.N.B. Wireless, Ltd., Messrs. Greenhill & Craig, Messrs. Payne and Hornsby, Ltd., Messrs. Percy & Co., Messrs. Kelly & Co., the *Irish Radio Journal*, Mr. L. R. Wood, the *Irish Radio and Musical Review*, Mr. Hogan, the Cork Radio Co., Mr. F. Barrett, the Irish Radio Stockists, Marconi (Ireland), Ltd., the Chloride Electrical Storage Co., Ltd., the General Electric Co., Ltd., Messrs. Brown Bros. (Ireland), Ltd., the Edison Swan Electric Co., Ltd., Messrs. Huet Bros., Messrs. J. Digby and Partner, and the British Thomson-Houston Co., Ltd.

Southport.—The recent second annual wireless exhibition arranged by the Southport Radio Society was very successful and attracted an attendance of 3,000 during the three days. Prizes were awarded to the constructors of receiving sets.

Trade-Mark Applications.

THE following are among the recent applications for British patents. Objections against any of the proposed marks may be entered within one month from November 3rd. In the case of foreign applications, the names and addresses of the British representatives are also given:—

L.E.C., Liverpool (lettering and design). No. 472,161. Wire in Class 5; No. 472,162. Class 8. Cables for electrical purposes; No. 472,163. Class 13. Insulated electric wire covered with lead; No. 136,113. Class 25. Wire covered with cotton; No. 472,164. Class 32. Wire covered with silk; No. 472,195. Class 39. Wire covered with paper; No. 472,197. Class 50. Wire covered with asbestos.—Liverpool Electric Cable Co., Ltd.

K.B.B. (lettering and design). No. 468,977. Class 8. Magnetic compasses, signalling apparatus, fitted electrical switchboards, &c. No. 468,978. Class 11. Instruments and apparatus for use in light therapy.—Kelvin, Bottomley and Baird, Ltd.

Mat (lettering and design). No. 468,998. Class 8. Electrical accessories.—La Compagnie Générale d'Electricité, 54, Rue de la Boetie, Paris. (Cruikshank & Fairweather, 65-68, Chancery Lane, W.C.2.)

Four Yellow Stripes (design only). No. 469,835. Class 8. Electric cables having a braided cover.—Callender's Cable and Construction Co., Ltd.

Orphean. No. 470,672. Class 8. Loud speakers for use in radio-telephony.—L. B. Tickle, 61, Borough Road, S.E.1.

Mellodyne. No. 472,378. All goods in Class 8.—Pollock Bros., 6, Exchange Street, Jedburgh.

Primus Autocel (lettering and design). No. 472,558. Class 8. High-tension dry batteries, and high-tension and low-tension accumulators for use in connection with radio-telegraphy and telephony.—Anglo-American Chemical Co., Ltd., 114-115, Great Saffron Hill, E.C.1.

Mazart says the Aravalve's melodious; it makes my music glorious (lettering and design). No. 473,410. Class 8. Valves for use in radio-telegraphy and telephony.—Naamlooze Vennootschap "Aravalves," Arnhem, Holland (McKenna & Co., 30-34, Basinghall Street, E.C.2.)

Northeaster (lettering and design). No. 473,392. Class 13. Electric horns.—North-East Electric Co., Rochester, N.Y. (Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Published Specifications.

Compiled expresely for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

9,161. "Thermionic valve holders." Lissen, Ltd., and R. P. Richardson. April 6th, 1925. (259,623.)

15,283. "Signalling apparatus especially adapted for mines." M. F. Bell. June 12th, 1925. (259,638.)

15,520. "Telephone systems." Standard Telephones and Cables, Ltd. (L. Polinkowsky). June 15th, 1925. ((259,642.)

16,706. "Aerial switches for radio apparatus." Igranic Electric Co., Ltd., and S. R. Wright. March 26th, 1926. (259,648.)

17,331. "Electric selective systems applicable to type-printing telegraphs and other purposes." L. Semat July 6th, 1925. (259,650.)

17,699. "Telephone transmitting apparatus." Standard Telephones and Cables, Ltd., and B. B. Grace. July 10th, 1925. (259,652.)

17,874. "Electric tea-drying machines." Drake & Gorham, Ltd., and R. H. M. Drake. July 13th, 1925. (259,657.)

17,908. "Resonator boxes for telephones and like appliances." H. O. Barnard. July 13th, 1925. (259,659.)

18,000. "Gain regulator of thermionic amplifiers." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). July 14th, 1925. (259,664.)

18,074. "Electric inductance coils." C. F. Halsall. July 15th, 1925. (259,673.)

18,097. "Radio-transmission systems." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories, Inc.). July 15th, 1925. (259,674.)

18,222. "Electric condensers." Faultless Radio Corporation. March 30th, 1925. (249,803.)

18,223. "Thermionic tubes." P. Schwarzkopf and Deutsche Gluhfadenfabrik R. Kurtz und Dr. P. Schwarzkopf Ges. July 16th, 1924. (237,270.)

18,530. "Apparatus for indicating or detecting electrically the reception of light." L. Donnellan. July 20th, 1925. (259,687.)

18,798. "Electrotherapeutic apparatus." E. N. Snowden. July 23rd, 1925. (259,689.)

19,012. "Basket-coil winding in wireless receivers." C. Aitchison. July 27th, 1925. (259,693.)

19,031. "Vacuum tubes and methods of making the same." British Thomson-Houston Co., Ltd. August 7th, 1924. (238,218.)

19,036. "Telephone systems." Standard Telephones and Cables, Ltd., G. Deakin and L. Polinkowsky. July 27th, 1925. (259,694.)

19,121. "Slow-speed control equipment for direct-current electric motors." H. Morris, Ltd., and A. Haslam. July 28th, 1925. (259,697.)

19,185. "Loud-speaking telephones." Lissen, Ltd., and R. P. Richardson. July 28th, 1925. (259,699.)

20,991. "Electric ignition in internal-combustion engines." E. Reichle. August 21st, 1925. (259,716.)

21,342. "Electro-magnetically-operated mechanism." Electrical Apparatus Co., Ltd., Aerozon Air Conditioning Co., Ltd., and J. R. Walton. August 26th, 1925. (259,719.)

22,889 "Fixed electric condensers." R. Woods. September 14th, 1925. (259,736.)

23,636. "Batteries, electric accumulators, and electrolysing apparatus." Soc. Anon. Le Carbone. December 10th, 1924. (244,417.)

25,910. "Accumulator plates." W. Haddon. October 16th, 1925. (259,764.)

26,013. "Explosion-proof centrifugal switches for starting induction motors." Akt.. Ges. Brown, Boveri et Cie. December 20th, 1924. (244,731.)

30,445. "Electric switches." British Thomson-Houston Co., Ltd. December 6th, 1924. (244,098.)

1926.

2,268. "Metallic filaments for electric incandescent lamps and methods of producing said filaments." Neue Gluhlampen Ges. November 19th, 1925. (259,810.)

4,339. "Steam-driven electric generating plant." Siemens-Schuckertwerke Ges. February 17th, 1925. (247,950.)

4,707. "Thermo-electric generators and the manufacture thereof." British Thomson-Houston Co., Ltd. March 31st, 1925. (250,188.)

4,739. "Alternating-current rectifiers." G.. Moschetti. February 18th, 1926. (259,816.)

4,949. "Means for operating electric switches." C. Logan and G. H. Harris. February 20th, 1926. (Cognate application 6,334/26.) (259,817.)

6,692. "Insulating devices for high-tension electrical apparatus." E. Haefely and Cie. Akt. Ges. March 20th, 1925. (249,506.)

8,742. "Apparatus for taking X-ray photographs." Siemens & Halske Akt. Ges. April 2nd, 1925. (250,244.)

9,589. "Rotors for dynamo-electric machines." Thyssen & Co. Akt. Ges. and A. Glaubitz. April 12th, 1926. (259,845.)

11,304. "Electric switches." British Thomson Houston Co., Ltd. April 30th, 1925. (251,643.)

11,606. "Loud-speaking telephones." G. Bowerman.. May 4th, 1925. (251,663.)

12,625. "Electric cigar-lighter." Elektrotechnische Fabrik Schoeller and Co., Ges. July 6th, 1925. (254,687.)

14,461. "Electro-acoustic systems." Marconi's Wireless Telegraph Co., Ltd. June 9th, 1925. (253,529.)

14,685. "Device for adjusting caps and bulbs of electric lamps or similar apparatus relatively to each other." Naamlooze Vennootschap Philips Gloeilampenfabrieken. June 12th, 1925. (253,544.)

15,060. "Means for suppressing high harmonics in the consumption circuit of rectifying plant." Siemens-Schuckertwerke Ges. June 16th, 1925. (253,914.)

15,591. "Liquid-insulated transformers." Allmanna Svenska Elektriska Aktiebolaget. July 4th, 1925. (254,699.)

15,699. "Hollow electric cables." Siemens-Schuckertwerke Ges. June 23rd, 1925. (254,308.)

16,047. "Method of starting synchronous motors or asynchronous motors with squirrel-cage armatures, which are coupled to gas-compressors." Akt. Ges. Brown, Boveri & Cie. July 2nd, 1925. (254,710.)

16,500. "Alternating-current electrical distribution systems." Metropolitan-Vickers Electrical Co., Ltd. July 2nd, 1925. (254,732.)

17,634. "Devices for measuring electric currents in Röntgen-ray tubes and the like." Dr. G. F. Du Prel. August 11th, 1925. (Divided application on 20,171/25.) (259,883.)

17,745. "Ignition apparatus for internal-combustion engines." International General Electric Co., Inc. July 16th, 1925. (255,472.)

18,130. "Means for securing caps of electric incandescent lamps and the like." General Electric Co., Ltd. April 22nd, 1926. (259,885.)

18,670. "Electric motor-control systems." Metropolitan-Vickers Electrical Co., Ltd. August 13th, 1925. (256,943.)

19,641. "Electrotherapeutic apparatus." E. N. Snowden. July 23rd, 1925. (Divided application on 259,689.) (259,892.)

The Electromobile Association.—We are informed that, starting from September 30th, in the current year, all new members elected and paying their first year's subscription before December 31st, 1926, will be entitled to membership of the Association from the date of such payment up till December 31st, 1927, when the next following year's subscription becomes due.